

ROCKY FLATS PLANT  
EMD OPERATING  
PROCEDURES MANUAL  
VOL I: FIELD OPERATIONS

Manual No.: 5-21000-OPS-FO  
New Manual No.: 4-11000-ER-OPS-FO  
Procedure No.: Table of Contents, Rev 67  
Page: 1 of 3  
Effective Date: 06/24/94  
Organization: Environmental Management

THIS IS ONE VOLUME OF A SIX VOLUME SET WHICH INCLUDES:

VOLUME I: FIELD OPERATIONS (FO)  
VOLUME II: GROUNDWATER (GW)  
VOLUME III: GEOTECHNICAL (GT)  
VOLUME IV: SURFACE WATER (SW)  
VOLUME V: ECOLOGY (EE)  
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PER R.B. HOFFMAN, CLASSIFICATION OFFICE  
JUNE 11, 1991

ADDITIONAL RECORD

A-SW-001293

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•FO.29	4-H46-ENV-OPS-FO.29	0	06/24/94
FO.32	4-I50-ENV-OPS-FO.32 Treated Effluent Discharge Operable Unit 1 (OU1), Building 891	0	04/13/94

## Rocky Flats Plant

4-H46-ENV-OPS-FO.29

REVISION 0

DISPOSITION OF SOIL AND SEDIMENT  
INVESTIGATION-DERIVED MATERIALS

APPROVED BY: [Signature] / J.G. STIGER / 1-5-17-94  
 Associate General Manager, Print Name Date  
 Environmental Restoration Management

[Signature] For M.C. Brooks / 1-5-17-94  
 Quality Assurance Program Manager, Print Name Date  
 Environmental Restoration Management

CONCURRENCE BY: No / [Signature] / 1-5-17-94  
 Assistant Manager, Print Name Date  
 Environmental Restoration Division  
 DOE, Rocky Flats Field Office  
*Signature per letter from Jessie M. Roberson (GR:BM:05814) to Sue G. Stiger*

Environmental Protection Agency Approval Required: ☒ Yes ☐ No

Responsible Organization: Environmental Restoration Management Effective Date: 6-24-94 *for*

CONCURRENCE BY THE FOLLOWING DISCIPLINES IS DOCUMENTED IN THE  
PROCEDURE HISTORY FILE:

ERM Remediation Project Management  
 ERM Geosciences  
 ERM Environmental Engineering & Technology  
 ERM Environmental Operations Management  
 ERM Sample Management  
 ERM Solar Ponds Project  
 Radiological Engineering  
 Industrial Hygiene  
 Occupational Safety

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USE CATEGORY 3

ORC review not required

Periodic review frequency: 1 year from the effective date

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1. PURPOSE

94.DMR-001226

This procedure is an interim procedure for classifying the backlog of soil and sediment investigation-derived material (IDM) generated from environmental investigations. Specifically, this procedure is used to determine a risk-based disposition of soil and sediment drums being managed in accordance with 4-F99-ENV-OPS-FO.23, Management of Soil and Sediment Investigation-derived Materials. This procedure, although specific for drums, may be extended to other containers such as crates or half crates, and to uncontained waste piles. IDM generated in the future will be classified in accordance with a modified procedure for the disposition of IDM. The modifications to this procedure will incorporate currently existing plant procedures and SW-846.

2. SCOPE

This procedure applies to all EG&G Rocky Flats, Inc. (EG&G) Environmental Restoration Management (ERM) employees and subcontractors involved in the disposition of soil and sediment IDM. A flow chart outlining the processes described in this procedure is shown in Appendix 1, IDM Evaluation Flow Chart.

This procedure addresses the following topics:

- Review of Form FO.23A
- Review of process knowledge and analytical results [in accordance with Appendix 2, Form FO.29A, IDM Resource Conservation Recovery Act (RCRA) Constituent of Concern and Toxicity Characteristic Leaching Procedure (TCLP) Determination (Form FO.29A) and Form FO.29D, Adequacy Determination (Form FO.29D)]
- Adequacy Determination Form (in accordance with Form FO.29D, Adequacy Determination Form in Appendix 2)
- Data management
- Comparison of reported detection limits (DL)
- Calculating average concentrations
- Metals comparison
- TCLP comparison
- IDM RCRA Constituents of Concern (in accordance with Appendix 3, IDM RCRA Constituents of Concern)
- Performing RCRA risk analysis [in accordance with Appendix 4, Form FO.29B, RCRA Risk Analysis (Form FO.29B)]
- Performing inclusive risk analysis [in accordance with Appendix 5, Form FO.29C, Inclusive Risk Analysis (Form FO.29C)]
- Managing IDM



### 3. OVERVIEW

This overview provides a descriptive summary of the steps required to complete 4-H46-ENV-OPS-FO.29. Chemical concentrations of various constituents in soils and sediments in drums are classified either by analytical results from corresponding field samples or by analytical results from IDM samples. The analyses are performed in accordance with approved individual project-specific work plans. Analytical results are recorded on Form FO.29A (Appendix 2). Radioactivity determinations will be addressed at a later date. Measured levels of organic compounds and metals detected in the soil and sediment IDM are compared with criteria defined in this procedure and are ultimately classified as one of the following:

Case No. 1:

Soil and sediment that contain IDM RCRA Constituents of Concern and/or IDM Constituents of Concern, which do not exhibit the characteristics of corrosivity, reactivity, or ignitability, which do not exceed adjusted TCLP regulatory levels, the RCRA risk-analysis criteria, the inclusive risk-analysis criteria, or that do not contain any metals above background and organics above the DL, and can be managed and disposed of in accordance with 4-F99-ENV-OPS-FO.23. However, an independent radiological evaluation is still required.

Case No. 2:

Soil and sediment that contain IDM RCRA Constituents of Concern (Appendix 3) which exhibit the characteristics of corrosivity, reactivity or ignitability, or exceed adjusted TCLP regulatory levels and/or exceed RCRA risk-analysis criteria, and will require management as a RCRA hazardous waste. However, an independent radiological evaluation is still required.

Case No. 3:

Soil and sediment that contain IDM RCRA Constituents of Concern and IDM Constituents of Concern exceeding inclusive risk-analysis criteria, and require management in accordance with the site-specific Record of Decision (ROD) when issued. However, an independent radiological evaluation is still required.

### 3.1 Background Comparison

It is unnecessary to assess the impact of metals detected at naturally occurring levels. To define the presence of constituents above background levels in soils and sediments, the concentrations of detected metals in the materials (or the average concentration when the drum contains IDM from more than one sampling interval in the borehole) will be compared with the mean plus two standard deviations (mean + 2SD) of background data, as defined using data from the Department of Energy (DOE) Background Geochemical Characterization Report. If the concentration of a metal is below the background mean + 2SD, the metal will be dropped from further consideration. If a background mean + 2SD cannot be obtained for a particular metal, that metal will be retained for further consideration.

### 3.2 TCLP Constituent of Concern Comparison

IDM with metals detected in concentrations above background mean + 2SD, metals with no associated mean + 2SD, and organic compounds detected above the Rocky Flats Environmental Database System (RFEDS) DL will be evaluated to determine if they include TCLP Constituents of Concern. TCLP Constituents of Concern are those constituents defined in 6 CCR 1007-3 Section 261.24. If TCLP Constituents of Concern are present, a TCLP Constituent of Concern comparison will be performed.

TCLP regulatory levels are determined for leachate extracted from a solid matrix and are expressed in terms of mg/L. However, soil and sediment IDM analytical results are reported in terms of mg/kg. The TCLP test itself has not been performed on most Rocky Flats Plant (RFP) investigation samples. Therefore, an approximation factor (AF) is used to convert the TCLP regulatory level to a soil concentration for comparison to soil analytical results. An AF of 20 has been selected for this purpose as required by the SW-846 Method 1311 for material containing greater than or equal to 0.5% solids. No TCLP comparison will be performed for constituents that do not have established TCLP regulatory levels, as identified in 6 CCR 1007-3 Section 261.24 or in Appendix 6, TCLP Regulatory Levels and Table of Risk-based Concentrations.

### 3.2 TCLP Constituent of Concern Comparison (continued)

If any one TCLP constituent concentration in the IDM exceeds the AF-adjusted TCLP regulatory level, then the corresponding drummed soil or sediment IDM will be managed as a RCRA waste. Even if an AF-adjusted TCLP regulatory level is exceeded, the remaining constituents in the IDM will be retained for evaluation in the RCRA risk analysis described in this procedure. Furthermore, constituents that do not exceed the adjusted TCLP comparison will be retained for evaluation in the RCRA and/or inclusive risk analysis described in this procedure.

### 3.3 IDM RCRA Constituents of Concern Evaluation and RCRA Risk Analysis

After the IDM has been evaluated to determine if it contains any TCLP Constituents of Concern, the IDM will then be evaluated to determine if any other IDM RCRA Constituents of Concern are present. Appendix 3 contains IDM RCRA Constituents of Concern. The IDM RCRA Constituents of Concern listed in Appendix 3 include all RCRA Appendix VIII constituents, except tentatively identified compounds (TICs), that have been reported as of 03/01/94 in the RFEDS. If a Constituent of Concern is reported from RFEDS but is not listed in Appendix 3, then the Constituent of Concern will be compared with Appendix VIII to 6 CCR 1007-3 Part 261 to determine if the Constituent of Concern is a RCRA waste. If any IDM RCRA Constituents of Concern are present, or any identified RCRA waste is present, a RCRA risk analysis will be performed. If IDM RCRA Constituents of Concern are not present, an inclusive risk analysis will be performed.

Both the RCRA and inclusive risk analyses evaluate the human exposure pathways of direct ingestion of soil, dermal absorption of constituents from soil, inhalation of suspended (airborne) soil, and ingestion of food grown in contaminated soil. Chemical-specific risk-based concentrations (RBCs) for soil are derived such that the risk from long-term exposure to the chemical concentration in soil corresponds to either a  $10^{-6}$  excess cancer risk or a Hazardous Quotient (HQ) of 1 for noncarcinogenic effects. Ratios of the chemical concentration in the IDM to the RBC are calculated. Then, the ratios of the constituent concentrations to the RBCs are summed, yielding a sum of carcinogenic risk ratios and a sum of noncarcinogenic hazard ratios.

### 3.3 IDM RCRA Constituents of Concern Evaluation and RCRA Risk Analysis (continued)

For IDM RCRA Constituents of Concern, if either the sum for carcinogenic effects exceeds 1 (representing a cumulative  $10^{-6}$  risk level) for exposure to multiple carcinogens or the sum for noncarcinogenic effects exceeds 1 [representing a cumulative Hazard Index (HI) of 1], the RCRA risk-analysis criteria are exceeded. If the RCRA risk-analysis criteria are exceeded, the IDM will be managed as a RCRA waste. If the IDM do not exceed the RCRA risk-analysis criteria, the IDM will be further evaluated in the inclusive risk analysis.

### 3.4 Inclusive Risk Analysis

An inclusive risk analysis will be performed on all IDM that did not exceed the RCRA risk-analysis criteria. The inclusive risk analysis is similar to the RCRA risk analysis except that all organic compounds detected above DLs and all metals above background levels are assessed whether they are IDM RCRA Constituents of Concern or not. The ratios of the constituent concentrations to the RBCs are summed as is done in the RCRA risk analysis.

For all IDM Constituents of Concern, if either the sum for carcinogenic effects exceeds 1 (representing a cumulative  $10^{-6}$  risk level) or the sum for noncarcinogenic effects exceeds 1 (representing a cumulative HI of 1), the inclusive risk-analysis criteria are exceeded. If the inclusive risk-analysis criteria are exceeded, the IDM will be managed as a non-RCRA [or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)] waste. If the inclusive risk-analysis criteria are not exceeded, the IDM will require management in accordance with 4-F99-ENV-OPS-FO.23.

### 3.5 Final IDM Classification

Based upon the results of the steps outlined in this procedure, the IDM will ultimately be classified as one of the following:

Case No. 1:

If the soil and sediment IDM previously evaluated did not exhibit the characteristics of corrosivity, ignitability, or reactivity, did not exceed the adjusted TCLP regulatory level, the RCRA risk-analysis criteria, and the inclusive risk-analysis criteria, or did not contain any metals above background and organic components above the DL, then the IDM can be managed as uncontaminated and disposed of in accordance with 4-F99-ENV-OPS-FO.23. However, an independent radiological evaluation is still required.

### 3.5 Final IDM Classification (continued)

#### Case No. 2:

If the soil and sediment IDM previously evaluated exhibited the characteristics of corrosivity, ignitability or reactivity or exceeded the adjusted TCLP regulatory level, and/or the RCRA risk-analysis criteria, then the IDM will require management as a RCRA hazardous waste. However, an independent radiological evaluation is still required.

#### Case No. 3:

If the soil and sediment IDM previously evaluated exceeded the inclusive risk-analysis criteria, then the IDM will require management as a non-RCRA waste containing Constituents of Concern in accordance with the site-specific ROD, when issued. However, an independent radiological evaluation is still required.

## 4. DEFINITIONS

**Toxicity Characteristic Leaching Procedure (TCLP).** An analytical method for extracting leachates to determine the mobility of both organic and inorganic contaminants present in liquid, solid, and multiphasic wastes. TCLP Constituents of Concern are those constituents as defined in 6 CCR 1007-3 Section 261.24. Although analytical results for soil and sediment IDM are expressed in terms of mg/kg, the results of TCLP analyses are expressed in terms of mg/L, and for these purposes, are considered equivalent to parts per million (ppm).

**Reported Detection Limits (DLs).** Detection limits reported in the RFEDS.

**Risk-based Concentrations (RBCs).** Concentration levels for individual chemicals in soil that correspond to either a  $10^{-6}$  excess cancer risk or an HQ of 1 for noncarcinogenic effects.

**Mean + 2SD.** Threshold limits of background data, as defined using data from the DOE Background Geochemical Characterization Report. The mean + 2SD provides the value to define the presence of constituents above background levels in soils and sediments. The mean + 2SD will be used in this procedure. Because most metal distributions in the background data are neither normal nor lognormal, the more conservative approach, in other words, the use of the mean and standard deviation as computed assuming a normal distribution, will be used for this procedure.

**5. RESPONSIBILITIES**

**5.1 ERM Environmental Engineering & Technology (EE&T)**

Documents personnel qualifications to perform this procedure in the project Quality Assurance (QA) files.

Ensures that this procedure is performed correctly.

**5.2 ERM Environmental Operations Management (EOM)**

Manages soil and sediment IDM in permitted and interim-status storage areas in accordance with applicable regulations and procedures.

**5.3 ERM Project File Center (PFC)**

Manages quality-related forms transmitted to the ERM PFC in accordance with 2-G18-ER-ADM-17.01, Quality Assurance Records Management.

**5.4 ERM Project Manager (PM)**

Evaluates analytical data from RFEDS to determine disposition of soil and sediment IDM.

Approves the data adequacy determination form.

Approves final soil determinations.

Assigns waste codes and labels the soil and sediment IDM.

**5.5 ERM Risk Management Personnel**

Conducts or oversees all risk analyses required by this procedure.

Recalculates risk-based soil concentrations by using up-to-date toxicity information on an annual basis in accordance with this procedure.

Revises the IDM RCRA Constituents of Concern list and the IDM Constituents of Concern list on an annual or as-needed basis as new Constituents of Concern are identified.

**5.6      ERM Sample Management - RFEDS**

Conducts data management.

**6.      TRAINING**

**ERM EE&T**

- [1]    Ensure that all personnel are appropriately trained and qualified to perform the duties, tasks, and responsibilities of their assigned jobs.
  
- [2]    Ensure that personnel training and qualification requirements for activities described in this procedure have been identified by the ERM Training and Qualification group.
  
- [3]    Ensure that ERM EG&G subcontractor personnel meet the required training and qualifications specified by the Training and Qualification group.
  
- [4]    Ensure that documentation and verification of both ERM-specific training and Performance Based Training has been documented by the Training and Qualification group.

7. INSTRUCTIONS

7.1 Review of Form FO.23A

General procedures for the management of the drums containing soil and sediment IDM are contained in 4-F99-ENV-OPS-FO.23. Form FO.23A, Soil and Sediment IDM Form, contains information to be used in the implementation of this procedure. The data reported on Form FO.23A were obtained in accordance with 4-F99-ENV-OPS-FO.23.

**NOTE** *Appendix 1 contains a flow chart outlining the processes described in this procedure.*

**ERM PM**

- [1] Obtain the applicable Form FO.23A or equivalent information.
- [2] IF a completed Form FO.23A or equivalent information is NOT available,  
THEN:
  - [A] Exit this procedure.
  - [B] Go to 4-F99-ENV-OPS-FO.23.
- [3] IF a completed Form FO.23A is available,  
THEN review the information on process knowledge on Form FO.23A.

**NOTE 1** *Form FO.29A (Appendix 2) is used for determining the disposition of soil and sediment IDM.*

**NOTE 2** *Appendix 7, Form FO.29E, Computer-generated Classification of IDM will be used before June 1, 1994 to replace Appendixes 2, 4, and 5 for the existing backlog of IDM drums. Form FO.29E is a computer-generated form that contains the essential information to classify the backlog of IDM drums. After June 1, 1994, Appendixes 2, 4, and 5 will be used to classify IDM drums.*

**ERM EE&T**

- [4] Ensure that Forms FO.29A, B, and C are used for all data except those for the backlog of drums containing IDM.



**7.2      Review of Process Knowledge and Analytical Results**

**ERM PM**

- [1] Record the following as required on Form FO.29A:
  - Rocky Flats Project
  - Date
  - ERM Project Manager
  - Soil Sample Location
  - Soil Depth Interval
  
- [2] Check (✓) the appropriate box on Form FO.29A to show whether process knowledge indicates that the IDM being evaluated potentially contains constituents with the following characteristics in accordance with 6 CCR 1007-3 Sections 261.20 - 261.23:
  - Corrosive
  - Ignitable
  - Reactive

**7.3      Adequacy Determination Form**

Form FO.29D documents that enough appropriate and adequate analytical information to perform a waste characterization evaluation is associated with each drum of IDM. Analytical information is appropriate and adequate when each drum has at least one set of data from each analytical method listed on the form. However, analytical information may still be considered appropriate and adequate where discrepancies or missing information are explained and documented as to the relevance of each analytical method by the ERM PM. A reason must be provided for analyses that were not performed and that rationale must be documented on Form FO.29D. If the ERM PM has determined that additional analytical methods and information would not assist in performing a waste characterization evaluation, then that (those) analytical method(s) would not be required to have been completed in order for the analytical information to be considered appropriate and adequate.

**ERM PM**

- [1] Obtain an Adequacy Determination Form (Form FO.29D) for each drum of IDM to be evaluated through the instructions specified in this procedure.

7.3 Adequacy Determination Form (continued)

ERM PM (continued)

[2] Record the following as required on Form FO.29D:

- Drum number
- Boring location
- Individual Hazardous Substance Site (IHSS) location
- Associated sample numbers
- Analytical method names for each sample

**NOTE 1** *Analytical samples used to classify soils and sediments are to be gathered in accordance with approved project-specific work plans.*

**NOTE 2** *Associated sample numbers and analytical method names for each drum of IDM can be obtained by querying the RFEDS database and specifically requesting this information.*

**NOTE 3** *When organic analytes in the database set are B-qualified (meaning that these analytes were detected in laboratory blanks), the data are usable but should be flagged. B-qualified data will be used in the risk assessment computations, and a comment will be added to either Form FO.29B, C, or E (whichever is appropriate) documenting that B-qualified data were used. If drums of IDM that had B-qualified data associated with them are determined to be above RCRA or CERCLA risk assessment criteria, the drum of IDM may require further evaluation to determine if the blank contamination (B-qualified data) inappropriately contributed to the determination of risk associated with the drum.*

[3] **IF** associated sample numbers and analytical method names for each sample are available from RFEDS,

**THEN** record on Form FO.29D whether the following analytical suites are available by checking [✓] the Yes or No column, as appropriate:

- VOAs
- BNAs [or semi-volatiles (SVOAs)]
- Pesticides/PCBs
- Metals
- Rads

7.3 Adequacy Determination Form (continued)

ERM PM (continued)

- [4] IF the response in Step 7.3[3] is Yes for all of the analytical methods,  
THEN:

[A] Sign or initial and date Form FO.29D.

[B] Go to Step 7.3[8].

- [5] IF the response in Step 7.3[3] is No for any of the analytical methods,  
THEN:

[A] Provide an answer to the question, *If no, why?*, on Form FO.29D for each No response.

[B] Perform the evaluation stipulated in Step 7.3[6] or [7], as appropriate.

The answer to this question will vary widely. The ERM PM may need to refer to the approved project-specific work plan or to historical release reports to confirm that this particular type of contamination was not of concern in the area from which the drum of IDM was obtained.

- [6] IF another analytical sample can be used to provide a more comprehensive waste characterization profile for the drum of IDM under evaluation,  
THEN record a Yes by *Can another sample be used to characterize this drum?* on Form FO.29D.

Analytical samples associated with nearby boreholes may, in some instances, be used to provide a more comprehensive waste characterization profile for the drum of IDM under evaluation. Whether an association using the following hierarchy is appropriate will be left to the professional discretion and judgment of the ERM PM.

7.3 Adequacy Determination Form (continued)

**NOTE 1** *The following hierarchy has been developed to assist in determining which samples can be used to provide missing analytical information. Whether a sample was taken at a more shallow depth within the same location (borehole) that was sampled for the missing analytical information will need to be determined. If such a sample is not available, the next consideration should be given to the closest borehole within the same IHSS for a sample taken to the same depth as the samples in the drum. If that information is not available, a sample may be used from up to that depth from any borehole within the IHSS. The final step in the hierarchy is to use a sample from below the depth of the other samples in the same borehole.*

**NOTE 2** *Historical information regarding sampling plan rationale for various areas may be obtained from individuals knowledgeable about patterns of contamination at the RFP, sampling plans and sampling strategies for the particular area from which the drum of IDM was obtained, or from the approved project-specific work plans.*

**ERM PM (continued)**

[7] **IF** another analytical sample **CANNOT** be used to provide a more comprehensive waste characterization profile for the drum of IDM under evaluation,  
**THEN** record a No by *Can another sample be used to characterize this drum?* on Form FO.29D.

[8] **WHEN** Form FO.29D is complete,  
**THEN:**

[A] Sign or initial and date Form FO.29D.

[B] Go to Step 7.3[9].

[9] Record on Form FO.29A whether the analytical data are adequate for drum characterization by checking (✓) the Yes or No box, as appropriate.

[10] **IF** the analytical data are **NOT** adequate to characterize the drummed IDM,  
**THEN:**

**7.3 Adequacy Determination Form (continued)**

**ERM PM (continued)**

[A] Exit this procedure.

[B] Review the approved project-specific work plan.

If the data are not adequate to characterize the drummed IDM, the ERM PM may decide to resample the drummed IDM. The ERM PM may request that a resample be taken of drummed IDM in accordance with 5-21000-OPS-FO.20, Rev. 0, Sampling Liquids and Solids from Environmental Materials Containers (when issued).

[11] **IF** the analytical data are adequate to characterize the drummed IDM,  
**THEN** perform the data management steps as stipulated in Section 7.4, Data Management.

**7.4 Data Management**

This section should be performed by a person with experience in data management. Data management can either be done on a drum-by-drum basis or for a larger data set.

**ERM PM**

[1] Do **NOT** use this procedure until all analytical information is available for a drum.

7.4 Data Management (continued)

ERM PM (continued)

- [2] WHEN the associated sample numbers are available for each drum,  
THEN request the analytical results from RFEDS.

The information required to complete the data management steps are:

- Location (that is, borehole number).
- Sample number.
- Sample type [such as sediment (SD) or borehole (BH)].
- Sample QA/QC code [such as REAL, duplicate (DUP), or rinsates (RNS)].
- Sample QC partner.
- Sample date.
- Test group code (that is, method name).
- Result type [such as target (TRG or TR<sub>n</sub>), dilution (DIL or DL<sub>n</sub>), replicate (REP or RP<sub>n</sub>), or re-extraction (REX or RX<sub>n</sub>, where n=1,2,3...)].
- Chemical.
- Parameter code.
- Lab QA code.
- Result.
- Unit measure.
- Error.
- Qualifier.
- Detect limit.
- Validation.
- Matrix.
- Secondary result type.

7.4 Data Management (continued)

**ERM Sample Management - RFEDS**

- [3] Do NOT provide to the ERM PM the following information or analytical results on either the RFEDS hardcopy or electronic copy, as appropriate:
- Tentatively identified organic compounds (TICs)
  - Nutrient species from the metals data (calcium, iron, magnesium, potassium, and sodium)
  - Silicon (or silica)
  - All analytes with the test method of WQPL except cyanide, nitrate or nitrite/nitrate, pH, and ignitability
  - All rinsates (RNS), trip blanks (TB), and matrix spikes/matrix spike duplicates (MS/MSDs); however, record these sample numbers to prove that they were not overlooked in the evaluation.
  - All sample numbers belonging to the RNS, TBs, and MS/MSDs from the list of sample numbers associated with the drum.
- [4] IF both a validated and an unvalidated result are available for a sample or analyte pair,  
THEN do NOT provide the unvalidated result to the ERM PM.
- [5] Determine if a sample has both a *DIL* (or *DL<sub>n</sub>*) or *REX* (or *RX<sub>n</sub>*) and *TRG* (or *TR<sub>n</sub>*) (lab QA codes) result for any analyte.
- [A] IF the *DIL* (or *DL<sub>n</sub>*) is U-qualified (nondetect),  
THEN do NOT provide the *TRG* (or *TR<sub>n</sub>*) (E-qualified) record for that analyte.
- [B] IF one of the pair of results is E-qualified,  
THEN:
- [a] Do NOT provide the E-qualified record for that analyte.
  - [b] Retain the other result.

7.4 Data Management (continued)

ERM Sample Management - RFEDS (continued)

[C] IF the *TRG* (or *TR<sub>n</sub>*) result has no data qualifier,  
THEN:

[a] Retain the *TRG* (or *TR<sub>n</sub>*) record for that analyte.

[b] Do NOT provide the *DIL* (or *DL<sub>n</sub>*) or *REX* (or *RX<sub>n</sub>*) for that analyte.

[6] Ensure that the analytical units for the soil and sediment samples are consistent and conform to the following:

- VOA, BNA, and PEST - UG/KG
- Metals - MG/KG
- Radionuclides (except tritium) - pCi/g
- Tritium - pCi/L
- Cyanide, Nitrate, and Nitrite/Nitrate - UG/G (equivalent to MG/KG)

Any data reported in units per liter (except tritium) cannot be evaluated by the computer program used in this procedure. The RBCs, TCLP comparison, and background mean + 2SD comparison included herein cannot be used for liquids.

[7] Determine if the QC partner (the REAL) is available for all DUPs.

[A] IF the REAL is available,  
AND both the REAL and DUP contain detected values,  
THEN:

[a] Average the DUP and REAL results for all of the detected compounds.

[b] Replace the REAL result with the average.

[c] Delete the original DUP record result.

[B] IF both the REAL and DUP results are U-qualified,  
THEN retain the sample concentration with the smaller number in the result column.



**7.4 Data Management (continued)**

**ERM Sample Management - RFEDS (continued)**

[C] IF either the REAL or DUP has a detected value and the other is U-qualified,  
THEN:

[a] Retain the detected value.

[b] Delete the U-qualified record.

[8] Convert all results, units, and detection limits to MG/KG for nonradionuclides.

[A] IF the laboratory reported the result in UG/KG,  
THEN convert the units to MG/KG, and divide the numbers in the result and  
detection limit columns by 1000.

Results for cyanide, nitrate, nitrate/nitrite are given in units of UG/G. Because  
UG/G is equivalent to MG/KG, only the unit's designation needs to be changed;  
the values in the result and detection limit columns remain unchanged.

**ERM PM**

[9] WHEN the data management has been completed,  
THEN review the results.

[10] IF all analytical results for a particular constituent are U-qualified,  
THEN do NOT evaluate this analyte any further.

[11] IF both detected and U-qualified analytical or all detected results exist for a particular  
constituent,  
THEN:

[A] Record the name of the analyte on Form FO.29A, Column 1.

[B] Record all analytical results for that constituent on Form FO.29A, Column 2.

**7.5      Comparison of Reported Detection Limits**

**ERM PM**

- [1] IF all constituents analyzed are U-qualified,  
THEN:
  - [A] Check [✓] the *All analytes U-qualified (nondetect)* box on Form FO.29A.
  - [B] Sign or initial Form FO.29A.
  - [C] Go to Section 7.12.
- [2] IF any constituent present in the soil and sediment IDM is NOT U-qualified,  
THEN go to Section 7.6, Calculating Average Concentrations.

**7.6      Calculating Average Concentrations**

**ERM PM**

- [1] IF there is more than one analytical result for a particular analyte for an individual drum,  
THEN calculate an average concentration.

The average concentration of detected constituents is calculated by replacing each U-qualified result with the detection limit divided by 2 and then using this value when the arithmetic mean is calculated on an analyte-by-analyte basis.
- [2] IF the analytical results for a particular constituent in an individual drum are all U-qualified,  
THEN do NOT evaluate the analyte any further.
- [3] Enter the arithmetic mean concentration on Form FO.29A, Column 3, as appropriate.
- [4] IF metal constituents are reported as being present in the IDM,  
THEN go to Section 7.7, Metals Comparison.
- [5] IF metal constituents are NOT reported as being present in the IDM,  
THEN go to Section 7.8, TCLP Comparison.

7.7 Metals Comparison

**ERM PM**

- [1] Compare the arithmetic mean value for each metal (obtained in the following steps) to the background mean + 2SD for that metal by using the mean + 2SD for geologic materials from the upper hydrostratigraphic unit [UHSU].

Table 1, Summary Statistics for UHSU Metals in Geologic Materials, presents the background mean + 2SD for geologic materials from the UHSU to be used in implementing this procedure.

- [2] Record the background mean + 2SD value obtained for metals on Form FO.29A, Column 4.
- [3] **IF** the average concentration of the metal is above the background mean + 2SD, **OR** if no background mean + 2SD exists for that particular metal, **THEN** record *Yes* on Form FO.29A, Column 5.
- [4] **IF** the average concentration of the metal is **NOT** above the background mean + 2SD, **THEN** record *No* on Form FO.29A, Column 5.
- [5] Remove from further evaluation any metal below the value of the background mean + 2SD.
- [6] **IF** metals are the only constituents in the soil and sediment IDM, **AND** each metal is below the respective background mean + 2SD, **THEN:**
  - [A] Check [✓] the *No Metals above background mean + 2SD and no organic compounds above reporting limits (uncontaminated material)* box on Form FO.29A.
  - [B] Sign or initial Form FO.29A.
  - [C] Go to Section 7.12.

Table 1. Summary Statistics for Metals in UHSU Geologic Materials.

ANALYTE	GEOLOGIC UNIT	SAMPLE SIZE, N	NON- DETECT	DETECT	PERCENT DETECTS	MEAN	STANDARD DEVIATION	MEAN + 2SD	UNITS
ALUMINUM	UHSU	98	1	97	98.98	12674	11372	35418	MG/KG
ANTIMONY	UHSU	66	56	11	16.67	6.28	1.89	10.06	MG/KG
ARSENIC	UHSU	99	29	70	70.71	3.5	4.42	12.34	MG/KG
BARIUM	UHSU	99	11	88	88.89	96.2	96.5	289.2	MG/KG
BERYLLIUM	UHSU	99	18	81	81.82	4.59	4.82	14.23	MG/KG
CADMIUM	UHSU	81	75	6	7.41	0.6	0.24	1.08	MG/KG
CALCIUM	UHSU	99	1	98	98.99	7053	16179	39411	MG/KG
CESIUM	UHSU	95	94	1	1.05	102.6	32.7	168	MG/KG
CHROMIUM	UHSU	99	15	84	84.85	18	25	68	MG/KG
COBALT	UHSU	99	77	22	22.22	6.86	5.33	17.52	MG/KG
COPPER	UHSU	99	5	94	94.95	12.55	12.8	38.15	MG/KG
IRON	UHSU	99	0	99	100.00	14532	13257	41046	MG/KG
LEAD	UHSU	99	1	98	98.99	10.83	7.09	25.01	MG/KG
LITHIUM	UHSU	99	38	61	61.62	9.75	8.38	26.51	MG/KG
MAGNESIUM	UHSU	99	4	95	95.96	2875	3232	9339	MG/KG
MANGANESE	UHSU	99	0	99	100.00	218	342	902	MG/KG
MERCURY	UHSU	86	64	22	25.58	0.167	0.147	0.461	MG/KG
MOLYBDENUM	UHSU	99	49	50	50.51	15.39	9.01	33.41	MG/KG
NICKEL	UHSU	96	14	82	85.42	19.14	20.86	60.86	MG/KG
POTASSIUM	UHSU	98	47	51	52.04	1545	1882	5309	MG/KG
SELENIUM	UHSU	82	80	2	2.44	0.996	1.253	3.502	MG/KG
SILVER	UHSU	83	50	33	39.76	5.66	9.41	24.48	MG/KG
SODIUM	UHSU	99	82	17	17.17	849	399	1647	MG/KG
STRONTIUM	UHSU	99	63	36	36.36	43.4	42.1	127.6	MG/KG
THALLIUM	UHSU	75	72	3	4.00	1.22	1.17	3.56	MG/KG
TIN	UHSU	92	67	25	27.17	67	110	287	MG/KG
VANADIUM	UHSU	99	2	97	97.98	31.5	28.5	88.5	MG/KG
ZINC	UHSU	98	7	91	92.86	35.9	51.6	139.1	MG/KG

NOTE: COMPUTED APRIL 7, 1994 USING DATA FROM 1993 BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

7.7 Metals Comparison (continued)

ERM PM (continued)

- [7] IF other constituents are present,  
OR metals exceed the background mean + 2SD,  
THEN go to Section 7.8.

7.8 TCLP Comparison

NOTE *If actual TCLP analysis was performed on any samples in a drum, then a straight TCLP comparison should be performed rather than using the approximation method described in Steps 7.8[3] through 7.8[5].*

ERM PM

- [1] IF any metal or any organic constituents has a *Yes* recorded on Form FO.29A, Column 5,  
THEN determine if a TCLP regulatory level is available in Appendix 6, Table 6-1, TCLP Constituents of Concern Maximum Contaminant Levels.
- [2] IF a TCLP regulatory level is available,  
THEN record the TCLP regulatory level for the constituent on Form FO.29A, Column 6.
- [3] Multiply the TCLP regulatory level by the AF (20) and record the value on Form FO.29, Column 7.
- [4] IF the AF-adjusted TCLP level on Form FO.29A, Column 7, is less than the constituent concentration in Column 3,  
THEN record *Yes* in Column 8 for that constituent.
- [5] IF the AF-adjusted TCLP level on Form FO.29A, Column 7, is greater than the constituent concentration in Column 3,  
THEN record *No* in Column 8.
- [6] IF at least one *Yes* was recorded on FO.29A, Column 8,  
THEN:
- [A] Check ☒ the *TCLP Regulatory Level Exceeded (RCRA hazardous waste)* box on Form FO.29A.

7.8 TCLP Comparison (continued)

ERM PM (continued)

[B] Go to Section 7.9, IDM RCRA Constituents of Concern.

[7] IF only *Nos* were recorded on Form FO.29A, Column 8,  
THEN:

[A] Check [☒] the *TCLP Regulatory Level Not Exceeded (perform RCRA risk analysis)* box on FO.29A.

[B] Sign or initial Form FO.29A.

[C] Go to Section 7.9, IDM RCRA Constituents of Concern.

7.9 IDM RCRA Constituents of Concern

ERM PM

[1] Evaluate if any constituent listed on Form FO.29A, Column 1, is an IDM RCRA Constituent of Concern.

The IDM RCRA Constituents of Concern are identified in Appendix 3.

[2] IF a constituent(s) listed on Form FO.29A, Column 1, is identified as a IDM RCRA Constituent of Concern in Appendix 3,  
THEN record *Yes* on Form FO.29A, Column 9, indicating that the constituent(s) is an IDM RCRA Constituent of Concern.

[3] IF a constituent(s) listed on Form FO.29A, Column 1, is NOT identified as an IDM RCRA Constituent of Concern in Appendix 3,  
THEN compare the constituent(s) with Appendix VIII to 6 CCR 1007-3 Part 261 to determine if the constituent(s) is a RCRA waste.

[4] IF the constituent(s) listed on Form FO.29A, Column 1, that is NOT identified as an IDM RCRA Constituent of Concern in Appendix 3 but is listed as a RCRA waste in Appendix VIII to 6 CCR 1007-3 Part 261,  
THEN record *Yes* on Form FO.29A, Column 9, indicating that the constituent(s) is an IDM RCRA Constituent of Concern.

7.9 IDM RCRA Constituents of Concern (continued)

ERM PM (continued)

- [5] IF the constituent(s) listed on Form FO.29A, Column 1, is NOT identified as an IDM RCRA Constituent of Concern in Appendix 3, AND is NOT listed as a RCRA waste in Appendix VIII to 6 CCR 1007-3 Part 261, THEN record *No* on Form FO.29A, Column 9, indicating that the constituent(s) is not an IDM RCRA Constituent of Concern.
- [6] IF no IDM RCRA Constituents of Concern are present, THEN:
- [A] Sign or initial Form FO.29A.
- [B] Forward Form FO.29A to ERM Risk Management for performance of an inclusive risk analysis in accordance with Section 7.11, Performing Inclusive Risk Analysis (Form FO.29C).
- [7] IF IDM RCRA Constituents of Concern are present, THEN:
- [A] Check [☒] the *IDM RCRA Constituents of Concern Present (perform RCRA risk analysis)* box on Form FO.29A.
- [B] Sign or initial Form FO.29A.
- [C] Forward Form FO.29A to ERM Risk Management to perform a RCRA risk analysis in accordance with Section 7.10, Performing RCRA Risk Analysis (Form FO.29B).

If a constituent is not identified as an IDM RCRA Constituent of Concern in Appendix 3 but is a RCRA waste in Appendix VIII to 6 CCR 1007-3 Part 261, then ERM Risk Management will include this constituent in the RCRA risk analysis and will calculate risk-based soil concentrations by using up-to-date toxicity information, as appropriate.

7.10 Performing RCRA Risk Analysis (Form FO.29B)

**NOTE** *A RCRA risk analysis is performed for all IDM RCRA Constituents of Concern and all identified RCRA wastes. The results are recorded on Form FO.29B in accordance with Appendix 5, Form FO.29B, RCRA Risk Analysis. A description of the calculation of RBCs is provided in Appendix 8, Risk-Analysis Method.*

**ERM Risk Management Personnel**

[1] Compare the analytical results for IDM RCRA Constituents of Concern listed on Form FO.29A with the RBCs for soil listed in Appendix 6, Table 6-2, IDM RCRA Constituents of Concern Carcinogens and Noncarcinogens Risk-based Concentrations for Soil, following the procedure described in this section.

[2] Record the following information on Form FO.29B:

- Rocky Flats Project
- Date
- ERM Project Manager
- Soil Sample Location
- Soil Depth Interval (if available)

**NOTE** *Organic compounds and metals that are IDM RCRA Constituents of Concern are identified on Form FO.29A, along with the associated individual and average concentrations.*

[3] Transfer the analyte names and concentrations from Form FO.29A, Columns 1 and 2, to Form FO.29B, Columns 1 and 2.

[4] Identify the carcinogenic and noncarcinogenic RBCs for each IDM RCRA Constituent of Concern in Appendix 6, Table 6-2.

[A] Record the carcinogenic and noncarcinogenic RBCs on Form FO.29B, Columns 3 and 5, respectively.

[B] IF no RBC is available for a particular constituent,  
THEN record NA on Form FO.29B, Columns 3 or 5, as appropriate.



**7.10 Performing RCRA Risk Analysis (Form FO.29B) (continued)**

**ERM Risk Management Personnel (continued)**

- [5] Calculate the carcinogenic and noncarcinogenic RBCs for each identified RCRA waste that is **NOT** identified as an IDM RCRA Constituent of Concern.
  - [A] Record the carcinogenic and noncarcinogenic RBCs on Form FO.29B, Columns 3 and 5, respectively.
  - [B] **IF** no RBC is available for a particular constituent,  
**THEN** record *NA* on Form FO.29B, Column 3 or 5, as appropriate.
- [6] **IF** an organic compound or metal has values recorded on Form FO.29B, Columns 2 and 3,  
**THEN:**
  - [A] Divide Column 2 by Column 3 for each constituent on Form FO.29B.
  - [B] Record the decimal fraction (ratio) on Form FO.29B, Column 4, for each constituent.
  - [C] Sum all of the ratios on Form FO.29B, Column 4, and record the sum in the *TOTAL* block at the bottom of the column.
  - [D] **IF** multiple pages for Form FO.29B are required,  
**THEN** use the *GRAND TOTAL* block to sum the *TOTAL* blocks for the analysis.
- [7] **IF** an organic compound or metal has a value recorded on Form FO.29B, Columns 2 and 5,  
**THEN:**
  - [A] Divide Column 2 by Column 5 for each constituent on Form FO.29B.
  - [B] Record the decimal fraction (ratio) on Form FO.29B, Column 6, for each constituent.
  - [C] Sum all of the ratios on Form FO.29B, Column 6, and record the sum in the *TOTAL* block at the bottom of the column.

**7.10 Performing RCRA Risk Analysis (Form FO.29B) (continued)**

**ERM Risk Management Personnel (continued)**

[D] IF multiple pages for Form FO.29B are required,  
THEN use the *GRAND TOTAL* block to sum the *TOTAL* blocks for the  
analysis.

[8] IF the *TOTALS* (or *GRAND TOTALS*) on Form FO.29B for both Columns 4 and 6 are  
equal to or less than 1,  
THEN:

[A] Check (✓) the *Total carcinogenic and noncarcinogenic ratios are both equal to  
or less than 1* box.

[B] Sign or initial Form FO.29B.

[C] Forward Form FO.29B to the ERM PM for approval.

**ERM PM**

[D] Review the answers provided on Form FO.29A for Step 7.2[2] and Steps 7.8[4]  
through 7.8[6].

[E] IF at least one *YES* is recorded in response to the questions or evaluations  
performed in either Step 7.2[2] or Steps 7.8[4] through 7.8[6],  
THEN:

[a] Review and sign or initial Form FO.29B.

[b] Go to Section 7.12.

7.10 Performing RCRA Risk Analysis (Form FO.29B) (continued)

**ERM PM (continued)**

- [F] IF all NOs were recorded in response to the questions or evaluations performed in either Step 7.2[2] or Steps 7.8[4] through 7.8[6],  
THEN:

- [a] Review and sign or initial Form FO.29B.

Any concerns or problems with Form FO.29B can be addressed with the ERM Risk Management Analyst responsible for that particular risk analysis before the form is approved.

- [b] Forward the approved Form FO.29B to the responsible ERM Risk Management Analyst.

**ERM Risk Management Personnel**

- [G] Perform an inclusive risk analysis on the drum of IDM in accordance with Section 7.11.

- [9] IF the *TOTAL* (or *GRAND TOTAL*, whichever is greater) on Form FO.29B for either Column 4 or 6 is greater than 1,  
THEN:

- [A] Check (✓) the *Total carcinogenic or noncarcinogenic ratio is greater than 1* box.

- [B] Sign or initial Form FO.29B.

- [C] Forward Form FO.29B to the ERM PM for approval.

**ERM PM**

- [D] Review and sign or initial Form FO.29B.

Any concerns or problems with Form FO.29B can be addressed with the ERM Risk Management Analyst responsible for that particular risk analysis before the form is approved.

- [E] Go to Section 7.12.

**7.11     Performing Inclusive Risk Analysis (Form FO.29C)**

**NOTE 1**     *An inclusive risk analysis is performed when either:*

- *No IDM RCRA Constituents of Concern are present as determined in Section 7.9, or*
- *Both the total carcinogenic and noncarcinogenic ratios for IDM RCRA Constituents of Concern are equal to or less than 1 as determined in Section 7.10, or the TCLP Regulatory Levels are not exceeded as determined in Section 7.8.*

**NOTE 2**     *Results of the inclusive risk analysis are recorded on Form FO.29C in accordance with Appendix 5, Inclusive Risk Analysis. A description of the calculation of RBCs is provided in Appendix 8.*

**ERM Risk Management Personnel**

- [1]     Compare the analytical results for IDM Constituents of Concern on Form FO.29A, Columns 1 and 2, with the RBCs for soil listed in Appendix 6, Table 6-3, IDM Constituents of Concern Carcinogenic and Noncarcinogenic Risk-based Concentrations for Soil, in accordance with this section.
- [2]     Record the following on Form FO.29C:
  - Rocky Flats Project
  - Date
  - ERM Project Manager
  - Soil Sample Location
  - Soil Depth Interval (if available)
- [3]     Transfer the analyte names and concentrations from Form FO.29A, Columns 1 and 2, to Form FO.29C, Columns 1 and 2.
- [4]     Identify the carcinogenic and noncarcinogenic RBCs for each organic compound and metal on Form FO.29C in Appendix 6, Table 6-3.
- [A]     Record the carcinogenic and noncarcinogenic RBCs on Form FO.29C, Columns 3 and 5, respectively.

**7.11 Performing Inclusive Risk Analysis (Form FO.29C) (continued)**

In those cases in which a constituent cannot be located on either the IDM RCRA Constituent of Concern List or the IDM Constituent of Concern List (both in Appendix 6), ERM Risk Management personnel will evaluate whether an RBC should be calculated for that constituent.

**ERM Risk Management Personnel (continued)**

- [B] IF no RBC is available for a particular constituent,  
THEN record *NA* on Form FO.29C, Columns 3 or 5, as appropriate.
  
- [5] IF an organic compound or metal has values recorded on Form FO.29C, Columns 2 and 3,  
THEN:
  - [A] Divide Column 2 by Column 3 for each constituent on Form FO.29C.
  - [B] Record the decimal fraction (ratio) on Form FO.29C, Column 4, for each constituent.
  - [C] Sum all of the ratios on Form FO.29C, Column 4, and record the sum in the *TOTAL* block at the bottom of the column.
  - [D] IF multiple pages for Form FO.29C are required,  
THEN use the *GRAND TOTAL* block to sum the *TOTAL* blocks for the analysis.
  
- [6] IF an organic compound or metal has values recorded on Form FO.29C, Columns 2 and 5,  
THEN:
  - [A] Divide Column 2 by Column 5 for each constituent on Form FO.29C.
  - [B] Record the decimal fraction (ratio) on Form FO.29C, Column 6, for each constituent.
  - [C] Sum all of the ratios on Form FO.29C, Column 6, and record the sum in the *TOTAL* block at the bottom of the column.

7.11 Performing Inclusive Risk Analysis (Form FO.29C) (continued)

**ERM Risk Management Personnel (continued)**

[D] IF multiple pages for Form FO.29C are required,  
THEN use the *GRAND TOTAL* block to sum the *TOTAL* blocks for the  
analysis.

[7] IF the *TOTALS* (or *GRAND TOTALS*) on Form FO.29C for both Columns 4 and 6,  
are less than or equal to 1,

THEN:

[A] Check (✓) the *Total carcinogenic and noncarcinogenic ratios are both less than  
or equal to 1* box.

[B] Sign or initial Form FO.29C.

[C] Forward Form FO.29C to the ERM PM for approval.

**ERM PM**

[D] Review and sign or initial Form FO.29C.

Any concerns or problems with Form FO.29C can be addressed with the ERM  
Risk Management Analyst responsible for that particular risk analysis before the  
form is approved.

[E] Go to Section 7.12.

**ERM Risk Management Personnel**

[8] IF the *TOTAL* (or *GRAND TOTAL*) blocks on Form FO.29C for either Columns 4 or  
6, is greater than 1,

THEN:

[A] Check (✓) the *Total carcinogenic or noncarcinogenic ratio is greater than 1*  
box.

[B] Sign or initial Form FO.29C.

[C] Forward Form FO.29C to the ERM PM for approval.

7.11 Performing Inclusive Risk Analysis (Form FO.29C) (continued)

ERM PM

[D] Review and sign or initial Form FO.29C.

Any concerns or problems with Form FO.29C can be addressed with the ERM Risk Management Analyst responsible for that particular risk analysis before the form is approved.

[E] Go to Section 7.12.

7.12 Managing IDM

**NOTE** *An independent radiological evaluation is still required but will be addressed at a later date.*

ERM EOM

[1] IF all of the following conditions exist:

- Form FO.29A, Column 5, is *No* for all metals,
- Both the *TOTAL* (or *GRAND TOTAL*) block on Form FO.29B, Columns 4 and 6, or on Form FO.29C, Columns 4 and 6, are both less than or equal to 1,
- The block is checked on Form FO.29A that states *TCLP regulatory level not exceeded (perform RCRA risk analysis)*,
- The block is checked on Form FO.29A that states *Corrosive, ignitable, or reactive (RCRA hazardous waste)*,

**THEN:**

[A] Transfer the drummed IDM out of the RCRA 90-day storage area.

[B] Manage the IDM in accordance with 4-F99-ENV-OPS-FO.23.

ERM PM

[2] IF *Yes* is recorded on Form FO.29A, Column 8, for any analyte,

OR the *TOTAL* (or *GRAND TOTAL*) blocks on Form FO.29B, in either Columns 4 or 6, are greater than 1,

**THEN:**

7.12 Managing IDM (continued)

ERM PM (continued)

- [A] Assign a waste code in accordance with the Hazardous Waste Requirements Manual (Manual 1-10000-HWR), Section 3.0, Waste Identification and Analysis.

- [B] If waste is not contained, place it in containers in accordance with SOP FO 8, Handling of Drilling Fluids and Cuttings, and SOP FO 10, Receiving, Labelling, and Handling Environmental Material Containers.

- [C] Complete labels for drums in accordance with the Waste Requirements Manual (Manual 1-1000-WRM) Procedure for Non-radioactive Waste Packaging (WP-1027).

- [D] Complete travelers for drums in accordance with the Waste Requirements Procedures Manual (Manual 5-2300-WRP) Procedure on Waste/Residue Traveler Instructions (WO-1102).

ERM EOM

- [E] Transfer the drums containing RCRA waste to Waste Operations for proper storage in permitted or interim-status facilities in accordance with 4-F99-ENV-OPS-FO.23.

ERM PM

- [3] IF the *TOTAL* (or *GRAND TOTAL*) blocks on Form FO.29C, in either Columns 4 or 6, are greater than 1,  
THEN:

- [A] If waste is not contained, place it in containers in accordance with SOP FO 8, Handling of Drilling Fluids and Cuttings, and SOP FO 10, Receiving, Labelling, and Handling Environmental Material Containers.

- [B] Complete a label for the drum, identifying the IDM as containing CERCLA hazardous substances greater than  $1 \times 10^{-6}$  with the disposition pending the ROD.

ERM EOM

- [C] Transfer the drums containing waste out of the 90-day storage area to an area to be determined for interim storage as non-RCRA waste.



The disposition of the non-RCRA IDM in interim storage will be determined by parties to the Interagency Agreement (IAG) and the public as part of the ROD for the area in which the IDM were generated.

**8. RECORDS**

Management of all records is consistent with 1-77000-RM-001, Records Management Guidance for Records Sources.

The records generated as a result of this procedure are considered quality records and are managed in accordance with 2-G18-ER-ADM-17.01. The records generated as a result of this procedure are also considered potential Administrative Records and are managed in accordance with 3-21000-ADM-17.02, Administrative Records Screening and Processing, in addition to 2-G18-ER-ADM-17.01.

There are no nonquality records generated by this procedure.

**ERM PM**

- [1] Ensure that the original and one copy of the following quality-related records, as appropriate, are transmitted to the ERM PFC in accordance with 2-G18-ER-ADM-17.01:

- Form FO.29A
- Form FO.29B
- Form FO.29C
- Form FO.29D
- Form FO.29E

Submission of record copies to the ERM PFC will satisfy Administrative Record requirements.

- [2] Ensure that one copy of the following quality-related records, as appropriate, is retained for the project file:

- Form FO.29A
- Form FO.29B
- Form FO.29C
- Form FO.29D
- Form FO.29E

8. RECORDS (continued)

ERM PM (continued)

[3] Ensure that one copy of the following quality-related records, as appropriate, is transmitted to ERM EOM:

- Form FO.29A
- Form FO.29B
- Form FO.29C
- Form FO.29D
- Form FO.29E

9. REFERENCES

CDH Interim Final Policy and Guidance on Risk Assessments for Corrective Action at RCRA Facilities, 11/93

Clement Associates, Comparative Potency Approach for Estimating the Cancer Risk Associated with Exposure to Mixtures of Polycyclic Aromatic Hydrocarbons, 1988

DOE, Background Geochemical Characterization Report, 09/93

DOE/CH/8901, A Manual for Implementing Residual Radioactive Material Guidelines, Argonne National Laboratory, 06/89

EPA, Health Effects Assessment Summary Tables (HEAST), 1993 (or current edition)

EPA, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, OSWER Directive 9285.6-03, 1991

EPA, Integrated Risk Information System (IRIS), 1994

EPA, New Interim Region IV Guidance (on Risk Assessment), 02/92

EPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, EPA/600/R-93/089, 07/93

EPA, Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, 1989

9. REFERENCES (continued)

1-10000-HWR, Hazardous Waste Requirements Manual, Section 3.0, Waste Identification and Analysis

1-10000-WRM, Waste Requirements Manual, WP-1027, Non-radioactive Waste Packaging

1-77000-RM-001, Records Management Guidance for Records Source

2-G18-ER-ADM-17.01, Quality Assurance Records Management (Until issued, use  
3-21000-ADM-17.01, Quality Assurance Records Management)

3-21000-ADM-17.02, Administrative Records Screening and Processing

4-F99-ENV-OPS-FO.23, Management of Soil and Sediment Investigation-derived Materials

5-23000-WRP, Waste Requirements Procedures Manual, WO-1102, Waste/Residue Traveler Instructions

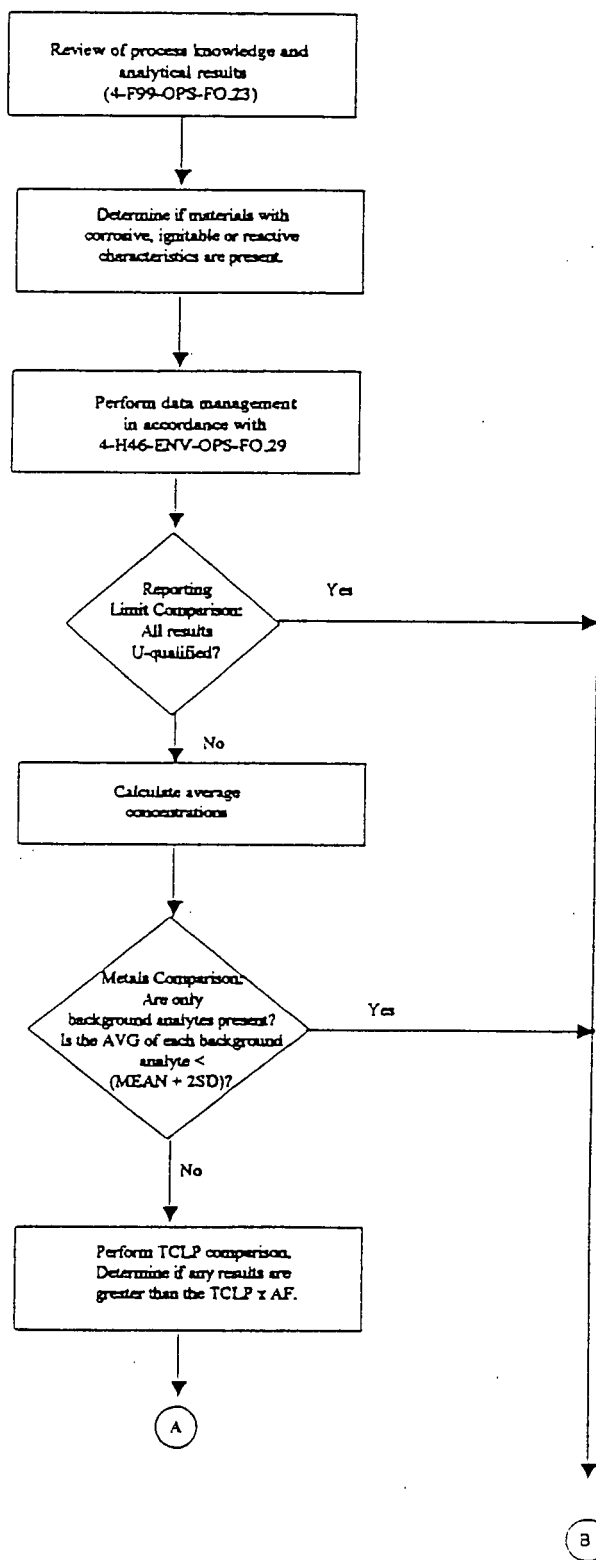
5-21000-OPS-FO.20, Sampling Liquids and Solids from Environmental Materials Containers (when issued)

6 CCR 1007-3 Part 261, Identification and Listing of Hazardous Waste, 06/93

APPENDIX 1

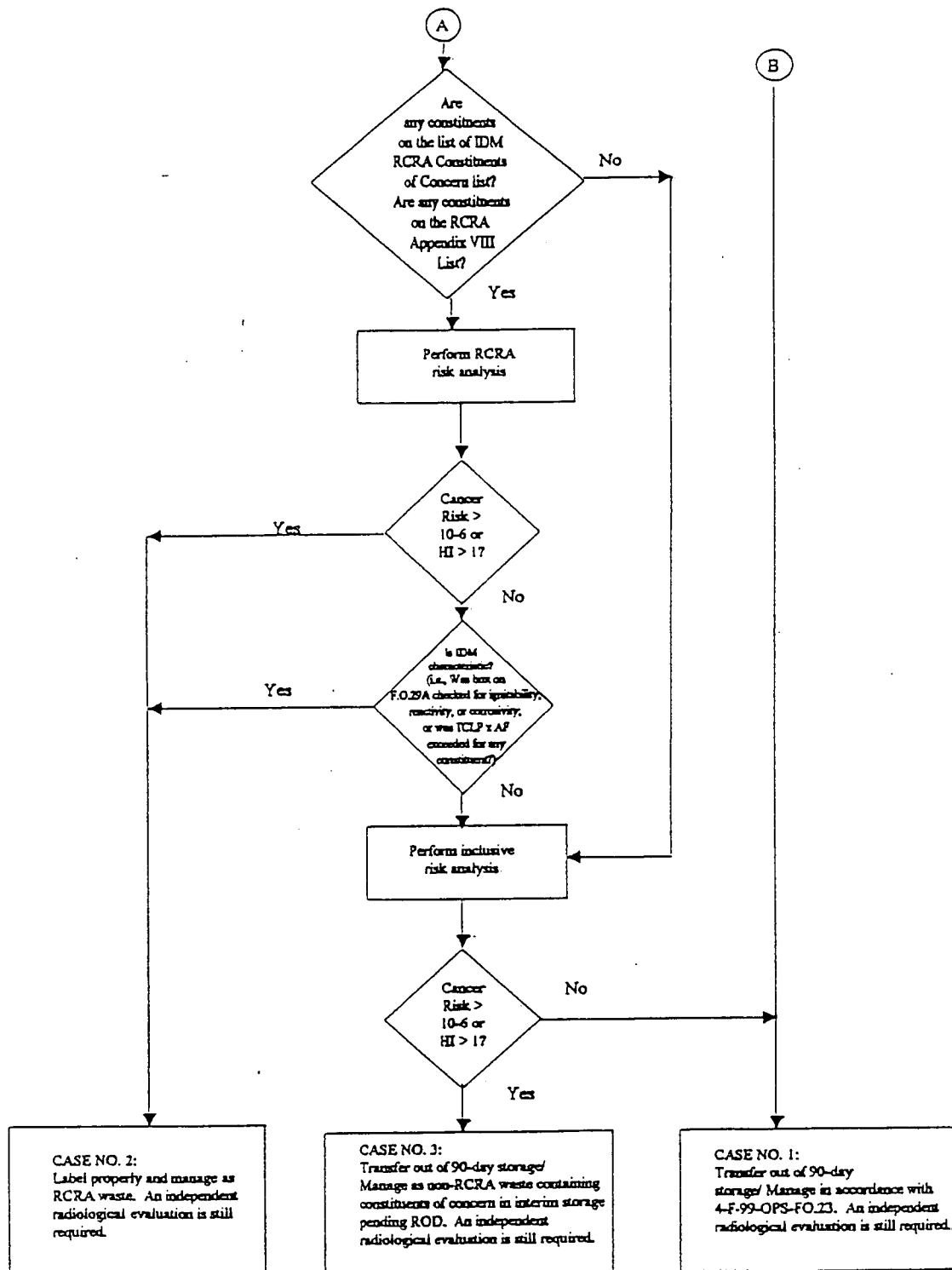
Page 1 of 2

IDM EVALUATION FLOW CHART



APPENDIX 1

Page 2 of 2



5/12/94

APPENDIX 2

Page 1 of 2

FORM FO.29A, IDM RCRA CONSTITUENT OF CONCERN AND TCLP DETERMINATION  
AND FORM FO.29D, ADEQUACY DETERMINATION

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT  
IDM RCRA CONSTITUENT OF CONCERN AND TCLP DETERMINATION

FORM FO.29A  
Page \_\_\_\_ of \_\_\_\_

Rocky Flats Project: \_\_\_\_\_  
Date: \_\_\_\_\_

Soil Sample Location: \_\_\_\_\_  
Soil Depth Interval: \_\_\_\_\_

ERM Project Manager: \_\_\_\_\_

Does the process knowledge indicate that the IDM being evaluated contains constituents with corrosive [ ], ignitable [ ], or reactive [ ] characteristics? (Check [✓] one)  
Are the analytical data adequate for drum characterization? (Check [✓] one) YES ☐ NO ☐

(1) Analyte Name	(2) Concentration or Activity (mg/kg or pCi/g)	(3) Average or Maximum Concentration (as applicable, mg/kg or pCi/g)	(4) Mean + 2SD (metals) (mg/kg)	(5) Analyte above Mean + 2SD (Yes/No)	(6) TCLP Regulatory Level (mg/L)	(7) TCLP Level X AF (mg/kg)	(8) Constituent Concentration Exceeds TCLP Level X AF? (Yes/No)	(9) IDM RCRA Constituents of Concern? (Yes/No)
SAMPLE								

- ☐ Corrosive, ignitable, or reactive (RCRA hazardous waste; perform RCRA risk analysis)
- ☐ All analytes U-qualified (nondetect)
- ☐ No metals above background mean + 2SD and no organic compounds above reporting limits (uncontaminated material)
- ☐ TCLP regulatory level exceeded (RCRA hazardous waste; perform RCRA risk analysis)
- ☐ TCLP regulatory level not exceeded (perform RCRA risk analysis)
- ☐ IDM RCRA Constituents of Concern present (perform RCRA risk analysis)
- ☐ Non-RCRA IDM Constituents of Concern present (perform inclusive risk analysis)

ERM Project Manager: \_\_\_\_\_ Date: \_\_\_\_\_

Comments: \_\_\_\_\_

The analytical information described on this form is based on information from potentially unvalidated data from RFEDS. This form has been completed in accordance with 4-H46-ENV-OPS-FO.29. A subcontractor was used in support of completing this form and the work has not been independently verified by the PM. Based on the above, this form is accurate to the best of the PM's knowledge and belief.

5/12/94

4-H46-ENV-OPS-FO.29  
REVISION 0  
PAGE 44 OF 70FORM FO.29D  
Page 1 of 1DISPOSITION OF SOIL AND SEDIMENT DATA  
ADEQUACY DETERMINATION FORMDRUM NO. \_\_\_\_\_  
BORING LOCATION \_\_\_\_\_  
HSS LOCATION \_\_\_\_\_

Associated Sample Nos.	Analytical Method Name	Associated Sample Nos.	Analytical Method Name
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Is the following analytical information available for this drum?

VOAs	Y _ N _	If no, why? _____ Can another sample be used to characterize this drum? _____ If yes, sample no. must be provided. _____
SVOCAs	Y _ N _	If no, why? _____ Can another sample be used to characterize this drum? _____ If yes, sample no. and rationale must be provided. _____
Pest/ PCBs	Y _ N _	If no, why? _____ Can another sample be used to characterize this drum? _____ If yes, sample no. and rationale must be provided. _____
Metals	Y _ N _	If no, why? _____ Can another sample be used to characterize this drum? _____ If yes, sample no. and rationale must be provided. _____
Rads	Y _ N _	If no, why? _____ Can another sample be used to characterize this drum? _____ If yes, sample no. and rationale must be provided. _____
Additional Comments _____		

ERM Project Manager \_\_\_\_\_

The analytical information described on this form is based on information from potentially unvalidated data from RFEDs. The criteria used to make the determination of whether the data consist of appropriate and adequate analytical information to perform a waste characterization evaluation is established in 4-H46-ENV-OPS-FO.29. A subcontractor was used in support of completing this form and their work has not been independently verified by the PM. Based on the above, this form is accurate to the best of the PM's knowledge and belief.

SAMPLE



## APPENDIX 3

Page 1 of 6

## IDM RCRA CONSTITUENTS OF CONCERN

Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
Acetone	2-Propanone		67-64-1
Acetonitrile	Same		75-05-8
Acetophenone	Ethanone, 1-phenyl-		98-86-2
2-Acetylamino-2-fluorone	Acetamide, N-9H-fluorenyl-		53-96-3
Acrolein	2-Propenal		107-02-3
Acrylonitrile	2-Propenenitrile		107-13-1
Aldrin	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10- 10-hexachloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5alpha,8alpha, 8abeta)-		309-00-2
Allyl chloride	1-Propane, 3-chloro	3-Chloropropene	107-18-6
4-Aminobiphenyl	[1,1'-Biphenyl]-4-amine		92-67-1
Aniline	Benzenamine		62-53-3
Antimony	Same		7440-36-0
Arsenite	Sulfurous acid, 2-chloroethyl 2-[4-(1,1- dimethylethyl)phenoxy]-1-methylethyl ester		140-57-8
Arsenic	Same		7440-38-2
Barium	Same		7440-39-3
Benzo[a]anthracene	Same		56-55-3
Benzene	Same		71-43-2
Benzidine	[1,1'-Biphenyl]-4,4'-diamine		92-87-5
Benzo[b]fluoranthene	Benz[e]acephenanthrylene		205-99-2
Benzo[k]fluoranthene	Same		207-08-9
Benzo[a]pyrene	Same		50-32-8
Beryllium	Same		7440-41-7
Bromodichloromethane			75-27-4
Bromoform	Methane, tribromo-		75-25-2
4-Bromophenyl phenyl ether	Benzene, 1-bromo-4-phenoxy-	p-Bromodiphenyl ether	101-55-3
Butyl benzyl phthalate	1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester		85-68-7
Caesium	Same		7440-43-9
Carbon disulfide	Same		75-15-0
Carbon tetrachloride	Methane, tetrachloro-		56-23-5
Chlordane	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8- octachloro-2,3,3a,4,7,7a-hexahydro-		57-74-9
Chlordane (alpha and gamma isomers)		Alpha-Chlordane	5103-71-9
		Gamma-Chlordane	5103-74-2
p-Chloroaniline	Benzenamine, 4-chloro-	4-Chloroaniline	106-47-8
Chlorobenzene	Benzene, chloro-		108-90-7
Chlorobenzilate	Benzenoacetic acid, 4-chloro-alpha-(4-chlorophenyl)-		510-15-6
p-Chloro-m-cresol	Phenol, 4-chloro-3-methyl-	4-Chloro-3-methylphenol	59-50-7
2-Chloroethyl vinyl ether	Ethene, (2-chloroethoxy)-		110(-7)5-8
Chloroethane			75-00-3
Chloroform	Methane, trichloro-		67-66-3
beta-Chloronaphthalene	Naphthalene, 2-chloro-	2-Chloronaphthalene	91-58-7
o-Chlorophenol	Phenol, 2-chloro-	2-Chlorophenol	95-57-8
Chloroprene	1,3-Butadiene, 2-chloro-	2-Chloro-1,3-Butadiene	126-99-8
Chromium	Same		7440-47-3
Chromium (III)			15065-83-1

**APPENDIX 3**

Page 2 of 6

Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
Chromium (VI)			18540-29-9
Chrysene	Same		218-01-9
m-Cresol	Phenol, 3-methyl	3-Methylphenol	108-39-4
o-Cresol	Phenol, 2-methyl	2-Methylphenol	95-48-7
p-Cresol	Phenol, 4-methyl	4-Methylphenol	106-44-5
Cyanide			57-12-5
2,4-D	Acetic acid, (2,4-dichlorophenoxy)-	2,4-Dichlorophenoxy- acetic acid, salts and esters	94-75-7
DDD	Benzene, 1,1'-(2,2-dichloroethylidene)bis(4-chloro-	4,4'-DDE 4,4'-DDD	72-54-8
DDE	Benzene, 1,1'-(dichloroethenylidene)bis(4-chloro-	4,4'-DDE 4,4'-DDE	72-55-9
DDT	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis(4-chloro-	4,4'-DDT 4,4'-DDT	50-29-3
Diallate	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester		2303-16-4
Dibenzo[a,h]anthracene	Same		53-70-3
1,2-Dibromo-3-chloropropane	Propane, 1,2-dibromo-3-chloro-		96-12-8
Dibromochloromethane			124-48-1
Dibutyl phthalate	1,2-Benzenedicarboxylic acid, dibutyl ester	Di-n-butyl phthalate	84-74-2
o-Dichlorobenzene	Benzene, 1,2-dichloro-	1,2-Dichlorobenzene	95-50-1
m-Dichlorobenzene	Benzene, 1,3-dichloro-	1,3-Dichlorobenzene	541-73-1
p-Dichlorobenzene	Benzene, 1,4-dichloro-	1,4-Dichlorobenzene	106-46-7
3,3'-Dichlorobenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro		91-94-1
1,4-Dichloro-2-butene	2-Butene, 1,4-dichloro-		764-41-0
trans-1,4-Dichloro-2-butene			110-57-6
Dichlorodifluoromethane	Methane, dichlorodifluoro-		75-71-8
1,1-Dichloroethene	Ethene, 1,1-dichloro-		75-35-4
1,2-Dichloroethene	Ethene, 1,2-dichloro-		156-60-5
cis-1,2-Dichloroethene			
trans-1,2-Dichloroethene			
Dichloroethyl ether	Ethane, 1,1'-oxybis(2-chloro-	Bis(2-chloroethyl) ether	111-44-4
Dichloroisopropyl ether	Propane, 2,2'-oxybis(2-chloro-	Bis(2-chloroisopropyl) ether	108-60-1
Dichloromethoxy ethane	Ethane, 1,1'-(methylenebis(oxy))bis(2-	Bis(2-chloroethoxy) methane	111-91-1
2,4-Dichlorophenol	Phenol, 2,4-dichloro-		120-83-2
2,6-Dichlorophenol	Phenol, 2,6-dichloro-		87-65-0
1,3-Dichloropropene	1-Propene, 1,3-dichloro-		542-75-6
cis-1,3-Dichloropropene			10061-01-5
trans-1,3-Dichloropropene			10061-02-06
Dieldrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7beta,7aalpha)-		60-57-1
1,4-Diethyleneoxide	1,4-Dioxane		123-91-1
Diethylhexyl phthalate	1,2-Benzenedicarboxylic acid, bis(2-	Bis(2-ethylhexyl) phthalate	117-81-7
Diethyl phthalate	1,2-Benzenedicarboxylic acid, diethyl ester		84-66-2
o,o-Diethyl o-pyrazinyl phosphorothioate	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester	Thionazin	297-97-2

APPENDIX 3

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Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
Dimethoate	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester		60-51-5
p-Dimethylaminoazobenzene	Benzenamine, N,N-dimethyl-4-(phenylazo)-		60-11-7
7,12-Dimethylbenz[a]anthracene	Benz[a]anthracene, 7,12-dimethyl-		57-97-6
3,3'-Dimethylbenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl	o-Tolidine	119-93-7
alpha, alpha-Dimethylphenethylamine	Benzeneethanamine, alpha, alpha-dimethyl-		122-09-8
2,4-Dimethylphenol	Phenol, 2,4-dimethyl-		105-67-9
Dimethyl phthalate	1,2-Benzenedicarboxylic acid, dimethyl		131-11-3
1,3-Dinitrobenzene	Benzene, dinitro-		25154-54-5
4,6-Dinitro-o-cresol	Phenol, 2-methyl-4,6-dinitro-	4,6-Dinitro-2-methylphenol	534-52-1
2,4-Dinitrophenol	Phenol, 2,4-dinitro-		51-28-5
2,4-Dinitrotoluene	Benzene, 1-methyl-2,4-dinitro-	1-Methyl-2,4-dinitrobenzene	121-14-2
2,6-Dinitrotoluene	Benzene, 2-methyl-1,3-dinitro-		606-20-2
Dinoseb	Phenol, 2-[(1-methylpropyl)-4,6-dinitro-		38-85-7
Di-n-octyl phthalate	1,2-Benzenedicarboxylic acid, dioctyl ester		117-84-0
Diphenylamine	Benzenamine, N-phenyl-		122-39-4
Disulfoton	Phosphorodithioic acid, O,O-diethyl S-[2-		298-04-4
Endosulfan	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a- hexahydro-, 3-oxide	Endosulfan I Endosulfan II	115-29-7
Endrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a- octa-hydro-, (1aalpha,2beta,2beta,3alpha,6alpha, 6alpha,7beta,7alpha)-		72-20-8
Endrin metabolites		Endrin aldehyde Endrin ketone	
Ethyl cyanide	Propanenitrile		107-12-0
Ethylene dibromide	Ethane, 1,2-dibromo-	1,2-Dibromoethane	106-93-4
Ethylene dichloride	Ethane, 1,2-dichloro-	1,2-Dichloroethane	107-06-2
Ethylidene dichloride	Ethane, 1,1-dichloro-	1,1-Dichloroethane	75-34-3
Ethyl methacrylate	2-Propenoic acid, 2-methyl-, ethyl ester		97-63-2
Ethyl methanesulfonate	Methanesulfonic acid, ethyl ester		62-50-0
Famphur	Phosphorothioic acid, O-[(4- [(dimethylamino)sulfonyl]phenyl] O,O- dimethyl ester		52-85-7
Fluoranthene	Same		206-44-0
Heptachlor	4,7-Methano-1H-indene, 1,4,5,6,7,8,8- heptachloro-3a,4,7,7a-tetrahydro-		76-44-8
Heptachlor epoxide	2,5-Methano-2H-indeno[1,2-b]oxirene, 2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a- hexa-hydro-, (1aalpha,1bbeta,2alpha,3alpha, 3alpha,6beta,6alpha)-		1024-57-3
Heptachlor epoxide (alpha, beta, and gamma)		Heptachlor Epoxide a Heptachlor Epoxide b	
Hexachlorobenzene	Benzene, hexachloro-		118-74-1
Hexachlorobutadiene	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-		87-68-3
Hexachlorocyclopentadiene	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro		77-47-4
Hexachloromethane	Ethane, hexachloro-		67-72-1

## APPENDIX 3

Page 4 of 6

Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
Hexachlorophene	Phenol, 2,2'-methylenebis[3,4,6-trichloro-		70-30-4
Hexachloropropene	1-Propene, 1,1,2,3,3,3-hexachloro-		1888-71-7
Indeno[1,2,3-cd]pyrene	Same		193-39-5
Isobutyl alcohol	1-Propanol, 2-methyl-		78-83-1
Isodrin	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-Dimethanonaphthalene	465-73-6
Isosafrole	1,3-Benzodioxole, 5-(1-propenyl)-		120-58-1
Kepone	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5a,5b,6-decachlorooctahydro-		143-50-0
Lead	Same		7439-92-1
Lindane	Cyclohexane, 1,2,3,4,5,6-hexachloro-	Gamma-BHC	58-89-9
Mercury	Same		7439-97-6
Methacrylonitrile	2-Propenenitrile, 2-methyl-		126-98-7
Methapylnene	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-		91-80-5
Methoxychlor	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis(4-methoxy-		72-43-5
Methyl bromide	Methane, bromo-	Bromomethane	74-83-9
Methyl chloride	Methane, chloro-	Chloromethane	74-87-3
Methyl chloroform	Ethane, 1,1,1-trichloro-	1,1,1-Trichloroethane	71-55-6
3-Methyl cholanthrene	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-		56-49-5
Methyl ethyl ketone	2-Butanone		78-93-3
Methyl iodide	Methane, iodo-	Iodomethane	74-88-4
Methyl methacrylate	2-Propenoic acid, 2-methyl-, methyl ester		80-62-6
Methyl methane sulfonate	Methanesulfonic acid, methyl ester	Methyl methanesulfonate	66-27-3
Methyl parathion	Phosphorothioic acid, O,O-dimethyl O-(nitrophenyl) ester	Parathion, methyl	298-00-0
4-Methyl-2-pentanone	Methyl isobutyl ketone		108-10-1
Methylene bromide	Methane, dibromo-	Dibromomethane	74-95-3
Methylene chloride	Methane, dichloro-		75-09-2
Naphthalene	Same		91-20-3
1,4-Naphthoquinone	1,4-Naphthalenedione		130-15-4
alpha-Naphthylamine	1-Naphthalenamine	1-Naphthylamine	134-32-7
beta-Naphthylamine	2-Naphthalenamine		91-59-8
Nickel	Same		7440-02-0
Nickel carbonyl	Nickel carbonyl, Ni(CO) <sub>4</sub> , (T-4)-		13463-39-3
Nickel cyanide	Nickel cyanide Ni(CN) <sub>2</sub>		557-19-7
p-Nitroaniline	Benzenamine, 4-nitro-	4-Nitroaniline	100-01-6
Nitrobenzene	Benzene, nitro-		98-95-3
p-Nitrophenol	Phenol, 4-nitro-	4-Nitrophenol	100-02-7
N-Nitroso-di-n-propylamine			621-64-7
N-Nitroso-di-n-butylamine	1-Butanamine, N-butyl-N-nitroso-	N-Nitrosodibutylamine	924-16-3
N-Nitrosodiethylamine	Ethanamine, N-ethyl-N-nitroso-		55-18-5
N-Nitrosodimethylamine	Methanamine, N-methyl-N-nitroso-		62-75-9
N-Nitrosomethylethylamine	Ethanamine, N-methyl-N-nitroso-		10595-95-6
N-Nitrosomorpholine	Morpholine, 4-nitroso-		59-39-2
N-Nitrosopiperidine	Piperidine, 1-nitroso		100-75-4
N-Nitrosopyrrolidine	Pyrrrolidine, 1-nitroso-		930-55-2

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Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
5-Nitro-o-toluidine	Benzenamine, 2-methyl-5-nitro-		99-55-3
Pentachlorobenzene	Benzene, pentachloro-		608-93-5
Pentachloroethane	Ethane, pentachloro-		76-01-7
Pentachloronitrobenzene	Benzene, pentachloronitro-		82-68-3
Pentachlorophenol	Phenol, pentachloro-		87-86-5
Phenacetin	Acetamide, N-(4-ethoxyphenyl)-		62-44-2
Phenol	Same		108-95-2
Phorate	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester		298-02-2
2-Picoline	Pyridine, 2-methyl-	2-methyl-pyridine	109-46-3
Polychlorinated biphenyls			
Aroclor-1016			12674-11-2
Aroclor-1221			11104-28-2
Aroclor-1232			11141-16-5
Aroclor-1242			53469-21-9
Aroclor-1248			12672-29-6
Aroclor-1254			11097-69-1
Aroclor-1260			11096-82-5
Pronamide	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-		23950-58-5
Propylene dichloride	Propane, 1,2-dichloro	1,2-Dichloropropane	78-37-5
Pyridine	Same		110-36-1
Safrole	1,3-Benzodioxole, 5-(2-propenyl)-		94-59-7
Selenium	Same		7782-49-2
Silver	Same		7440-22-4
1,2,4,5-Tetrachlorobenzene	Benzene, 1,2,4,5-tetrachloro-		95-94-3
1,1,1,2-Tetrachloroethane	Ethane, 1,1,1,2-tetrachloro-		630-20-6
1,1,2,2-Tetrachloroethane	Ethane, 1,1,2,2-tetrachloro-		79-34-5
Tetrachloroethene	Ethene, tetrachloro-		127-18-4
2,3,4,6-Tetrachlorophenol	Phenol, 2,3,4,5-tetrachloro-		58-90-2
Tetraethyldithiopyrophosphate	Thiodiphosphoric acid, tetraethyl ester	Sulfotep	3689-24-5
Tetraethylpyrophosphate	Diphosphoric acid, tetraethyl ester	Tetraethyl pyrophosphate	107-49-3
Thallic oxide	Thallium oxide Tl <sub>2</sub> O <sub>3</sub>		1314-32-5
Thallium acetate	Acetic acid, thallium (1+) salt		563-68-8
Thallium carbonate	Carbonic acid, dithallium (1+) salt		6533-73-9
Thallium chloride	Thallium chloride TlCl		7791-12-0
Thallium nitrate	Nitric acid, thallium (1+) salt		10102-45-1
Thallium selenite	Selenious acid, dithallium (1+) salt		12039-52-0
Thallium (I) sulfate	Sulfuric acid, dithallium (1+) salt		7446-18-6
Toluene	Benzene, methyl-		108-38-3
o-Toluidine			95-53-4
p-Toluidine	Benzenamine, 4-methyl-		106-49-0
Toxaphene	Same		8001-35-2
1,2,4-Trichlorobenzene	Benzene, 1,2,4-trichloro-		120-82-1
1,1,2-Trichloroethane	Ethane, 1,1,2-trichloro-		79-00-5
Trichloroethene	Ethene, trichloro-		79-01-6
Trichlorofluoromethane	Methane, trichlorofluoro-		75-69-4
2,4,5-Trichlorophenol	Phenol, 2,4,5-trichloro-		95-95-4
2,4,6-Trichlorophenol	Phenol, 2,4,6-trichloro-		88-06-2
1,2,3-Trichloropropane	Propane, 1,2,3-trichloro		96-18-4

**APPENDIX 3**

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Common Name	Chemical Abstracts Name	Other Synonyms	CAS No.
O,O,O-Triethyl phosphorothioate	Phosphorothioic acid, O,O,O-triethyl ester		126-68-1
2,4,5-Trichlorophenoxyacetic acid	Acetic acid, (2,4,5-trichlorophenoxy)-		93-76-5
2,4,5-Trichlorophenoxypropanoic acid	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-		93-72-1
1,3,5-Trinitrobenzene	Benzene, 1,3,5-trinitro-		99-55-4
m-Xylene	m-Benzene, dimethyl		108-38-3
o-Xylene	o-Benzene, dimethyl		95-47-6
p-Xylene	p-Benzene, dimethyl		106-42-3
Total Xylene (mixed isomers)	Benzene, dimethyl		1330-20-7
Vinyl chloride	Ethene, chloro-		75-01-4

1. IRIS, April 7, 1994
2. HEAST, FY-1993 Annual and Supplement 1.
3. EPA 1993

**APPENDIX 4**

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**FORM FO.29B  
RCRA RISK ANALYSIS**

FORM FO.29B

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

**RCRA RISK ANALYSIS**

Page \_\_\_\_ of \_\_\_\_

Rocky Flats Project: \_\_\_\_\_  
Date: \_\_\_\_\_  
Soil Sample Location: \_\_\_\_\_  
Soil Depth Interval: \_\_\_\_\_

ERM Project Manager: \_\_\_\_\_

(1) Metal or Organic Compound Name	(2) Metal or Organic Compound Concentration (mg/kg)	(3) Carcinogenic Risk-based Soil Concentration (mg/kg)	(4) Carcinogenic Ratio (average concentration/RBCc)	(5) Noncarcinogenic Risk-based Soil Concentration (mg/kg)	(6) Noncarcinogenic Ratio (average concentration/RBCc)
<b>SAMPLE</b>					
		TOTAL		TOTAL	
		GRAND TOTAL		GRAND TOTAL	

- ☐ Total carcinogenic and noncarcinogenic ratios are both equal to or less than 1.  
☐ Either total carcinogenic or noncarcinogenic ratio is greater than 1.

ERM Project Manager: \_\_\_\_\_ Date: \_\_\_\_\_

ERM Risk Analyst: \_\_\_\_\_ Date: \_\_\_\_\_

Comments: \_\_\_\_\_

The analytical information described on this form is based on information from potentially unvalidated data from RFEDS. This form has been completed in accordance with 4-H46-ENV-OPS-FO.29. A subcontractor was used in support of completing this form and the work has not been independently verified by the PM. Based on the above, this form is accurate to the best of the PM's knowledge and belief.

APPENDIX 5

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FORM FO.29C  
INCLUSIVE RISK ANALYSIS

FORM FO.29C

## INCLUSIVE RISK ANALYSIS

U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

Rocky Flats Project: \_\_\_\_\_  
Date: \_\_\_\_\_  
Soil Sample Location: \_\_\_\_\_  
Soil Depth Interval: \_\_\_\_\_

Page \_\_\_\_ of \_\_\_\_

ERM Project Manager: \_\_\_\_\_

(1) Metal or Organic Compounds Name	(2) Metal or Organic Compounds Concentration or Activity (mg/kg or pCi/g)	(3) Carcinogenic Risk-based Soil Concentration (mg/kg or pCi/g)	(4) Carcinogenic Ratio (average concentration/RBCc)	(5) Noncarcinogenic Risk-based Soil Concentration (mg/kg)	(6) Noncarcinogenic Ratio (average concentration/RBCc)
SAMPLE					
TOTAL			TOTAL		
GRAND TOTAL			GRAND TOTAL		

- ☐ Total carcinogenic and noncarcinogenic ratios are both less than or equal to 1.  
☐ Either total carcinogenic or noncarcinogenic ratio is greater than 1.

ERM Project Manager: \_\_\_\_\_ Date: \_\_\_\_\_

ERM Risk Analyst: \_\_\_\_\_ Date: \_\_\_\_\_

Comments: \_\_\_\_\_

The analytical information described on this form is based on information from potentially unvalidated data from RFEDS. This form has been completed in accordance with 4-H46-ENV-OPS-FO.29. A subcontractor was used in support of completing this form and the work has not been independently verified by the PM. Based on the above, this form is accurate to the best of the PM's knowledge and belief.



**APPENDIX 6**

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**TCLP REGULATORY LEVELS AND TABLE OF RISK-BASED CONCENTRATIONS**

TABLE 6-1

**TCLP CONSTITUENTS OF CONCERN MAXIMUM CONTAMINATION LEVELS**

CHEMICAL	REGULATORY LEVEL (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0*
m-Cresol	200.0*
p-Cresol	200.0*
Cresol	200.0*
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1,-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13*
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13*
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethylketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0*
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2

\* If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (DO26) concentration is used. The regulatory level of total cresol is 200 mg/l.  
\* Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

## APPENDIX 6

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TABLE 6-2

IDM RCRA CONSTITUENTS OF CONCERN

# CARCINOGENS AND NONCARCINOGENS RISK-BASED CONCENTRATIONS FOR SOIL

[illegible]

## APPENDIX 6

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TABLE 6-2 (continued)

[illegible]

## APPENDIX 6

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TABLE 6-2 (continued)

Chemical Name	References	Oral Unit Risk 1/(mg/kg-day)	Oral Slope Factor 1/(mg/kg-day)	Inhalation Unit Risk 1/(mg/m <sup>3</sup> )	Inhalation Slope Factor 1/(mg/m <sup>3</sup> -day)	Oral RfD (mg/kg-day)	Inhalation RfC (mg/m <sup>3</sup> )	Inhalation RfD (mg/kg-day)	RfC <sub>o</sub> (mg/kg)	RfC <sub>in</sub> (mg/kg)
Dichloroethyl ether	1	-	1.1E+00	3.3E-04	1.2E+00	-	-	-	0.02970885	NA
Dichloropropyl ether	1,2	2.0E-06	7.0E-02	1.0E-05	3.5E-02	-	-	-	0.46685341	NA
Dichloromethoxy ethane	-	-	-	-	-	-	-	-	NA	NA
2,4-Dichlorophenol	1	-	-	-	-	-	-	-	NA	NA
2,6-Dichlorophenol	-	-	-	-	-	-	-	-	NA	41.8410012
1,3-Dichloropropene	1,2	5.1E-06	1.8E-01	3.7E-05	1.3E-01	3.0E-01	2.0E-02	5.7E-03	0.1815541	4.18410042
cis-1,3-Dichloropropene	1,2	5.1E-06	1.8E-01	3.7E-05	1.3E-01	3.0E-01	2.0E-02	5.7E-03	0.1815541	4.18410042
trans-1,3-Dichloropropene	1,2	5.1E-06	1.8E-01	3.7E-05	1.3E-01	3.0E-01	2.0E-02	5.7E-03	0.1815541	4.18410042
Dichloro	1	-	1.6E+01	4.6E-03	1.6E+01	5.0E-05	-	-	0.00204248	0.69735007
1,4-Dichlorobenzene	1	-	1.1E-02	-	-	-	-	-	2.97088532	NA
Dichloroethyl phthalate	1	-	1.4E-02	-	-	2.0E-02	-	-	2.33426704	278.940028
Dichlorophthalate	1	-	-	-	-	8.0E-01	-	-	NA	11157.6011
o,o-Dichloro-o-pyrazinyl phosphoro-thioate	-	-	-	-	-	-	-	-	NA	NA
Dimethoate	1	-	-	-	-	2.0E-04	-	-	NA	2.78940028
1,4-Dimethylaminobenzene	-	-	-	-	-	-	-	-	NA	NA
7,12-Dimethylbenzofluanthracene	-	-	-	-	-	-	-	-	NA	NA
3,3'-Dimethylbenzidine	-	-	-	-	-	-	-	-	NA	NA
alpha, alpha-Dimethylphenethylamine	-	-	-	-	-	-	-	-	NA	NA
2,1-Dimethylphenol	1	-	-	-	-	2.0E-02	-	-	NA	278.940028
Dimethyl phthalate	2	-	-	-	-	1.0E+01	-	-	NA	139470014
1,3-Dinitrobenzene	1	-	-	-	-	1.0E-01	-	-	NA	1.39470014
1,6-Dinitro-o-cresol	-	-	-	-	-	-	-	-	NA	NA
2,4-Dinitrophenol	1	-	-	-	-	2.0E-03	-	-	NA	27.8940028
2,1-Dinitrobenzene	1	-	-	-	-	2.0E-03	-	-	NA	27.8940028
2,6-Dinitrobenzene	2	-	-	-	-	1.0E-03	-	-	NA	13.9470014
Dinitroeb	1	-	-	-	-	1.0E-03	-	-	NA	13.9470014
Di-n-octyl phthalate	2	-	-	-	-	2.0E-02	-	-	NA	278.940028
Diphenylamine	1	-	-	-	-	2.5E-02	-	-	NA	348.675015
Dibutyltin	1	-	-	-	-	4.0E-05	-	-	NA	0.55788006
Dichloroethan	2	-	-	-	-	6.0E-03	-	-	NA	83.6820084
Dichloro	1	-	-	-	-	3.0E-04	-	-	NA	4.18410042
Dichloromethoxy ethyl	-	-	-	-	-	-	-	-	NA	NA
Dibutyl cyanide	-	-	-	-	-	-	-	-	NA	NA
Dibutyltin dibromide	1,2	-	8.5E+01	2.2E-04	7.7E-01	-	2.0E-04	5.7E-05	0.00038447	NA

## APPENDIX 6

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TABLE 6-2 (continued)

[illegible]

## APPENDIX 6

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TABLE 6-2 (continued)

Chemical Name	Reference	Oral Unit Risk (1/mg.d)	Oral Slope Factor (1/mg/kg-day)	Inhalation Unit Risk (1/mg/m <sup>3</sup> )	Inhalation Slope Factor (1/mg/kg-day)	Inhalation Unit Risk (1/mg/m <sup>3</sup> )	Inhalation Slope Factor (1/mg/kg-day)	Inhalation Unit Risk (1/mg/m <sup>3</sup> )	Inhalation Slope Factor (1/mg/kg-day)	Reference
Methyl parathion	1	-	-	-	2.50E-01	-	-	-	-	3-48675015 NA
1-Methyl-2-pyrimidinone	2	-	-	-	5.00E-02	-	-	-	-	697.350017 NA
Methylene bromide	-	-	-	-	-	-	-	-	-	NA
Methylene chloride	1,2	2.10E-07	7.50E-03	4.70E-07	1.64E-03	6.00E-02	3.0E+00	-	-	4.35729817 936.820081 NA
Naphthalene	-	-	-	-	-	-	-	-	-	NA
1,4-Naphthoquinone	-	-	-	-	-	-	-	-	-	NA
1-Hydroxy-Naphthylamine	-	-	-	-	-	-	-	-	-	NA
1-Hydroxy-Naphthylamine	-	-	-	-	-	-	-	-	-	NA
Nickel	-	-	-	-	-	-	-	-	-	NA
Nickel carbonyl	-	-	-	-	-	-	-	-	-	NA
Nickel cyanide	-	-	-	-	-	-	-	-	-	NA
p-Nitroaniline	1	-	-	-	-	-	-	-	-	NA
p-Nitrophenol	-	-	-	-	-	-	-	-	-	NA
N-Nitroso-di-n-propylamine	1	1.60E-04	5.40E+00	1.60E-03	5.59E+00	-	-	0.00466853 NA	-	0.00466853 NA
N-Nitroso-di-n-butylamine	1	1.30E-03	1.50E+02	4.30E-02	1.50E+02	-	-	0.00021786 NA	-	0.00021786 NA
N-Nitrosodimethylamine	1	1.40E-03	5.10E+01	1.40E-02	4.90E+01	-	-	0.00064078 NA	-	0.00064078 NA
N-Nitrosomethylthylamine	1	6.30E-04	2.20E+01	-	-	-	-	0.00148544 NA	-	0.00148544 NA
N-Nitrosomethylthylamine	-	-	-	-	-	-	-	NA	-	NA
N-Nitrosopyrrolidine	-	-	-	-	-	-	-	NA	-	NA
N-Nitrosopyrrolidine	1	6.10E-05	2.10E+00	6.10E-04	2.13E+00	-	-	0.01556178 NA	-	0.01556178 NA
5-Methyl-2-thiophenol	1	-	-	-	8.00E-04	-	-	11.1576011 NA	-	11.1576011 NA
5-Methyl-2-thiophenol	-	-	-	-	-	-	-	NA	-	NA
2-Methyl-4-thiophenol	1,2	7.40E-06	2.60E-01	-	3.00E-03	-	-	0.1256913 NA	-	0.1256913 NA
2-Methyl-4-thiophenol	-	-	-	-	-	-	-	41.8410013 NA	-	41.8410013 NA
2-Methyl-4-thiophenol	1	-	1.20E-04	-	3.00E-02	-	-	0.27233115 NA	-	0.27233115 NA
Thiobenzene	1	-	-	-	6.00E-01	-	-	8368.20084 NA	-	8368.20084 NA
Thiobenzene	2	-	-	-	2.00E-04	-	-	2.78940028 NA	-	2.78940028 NA
2-Thiophenol	-	-	-	-	-	-	-	NA	-	NA
2-Thiophenol	1	2.20E-04	7.70E+00	7.70E+00	7.40E-05	-	-	0.00424412 NA	-	0.00424412 NA
2-Thiophenol	1	-	7.70E+00	7.70E+00	7.40E-05	-	-	0.00424412 NA	-	0.00424412 NA
2-Thiophenol	1	-	7.70E+00	7.70E+00	7.40E-05	-	-	0.00424412 NA	-	0.00424412 NA

5/12/94

## APPENDIX 6

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TABLE 6-2 (continued)

Common Name	Reference	Oral Unit Risk 1/(mg/L)	Factor 1/(mg/kg-day)	Inhalation Unit Risk 1/(µg/m <sup>3</sup> )	Slope Factor 1/(mg/kg-day)	Inhalation PIC (mg/m <sup>3</sup> )	Inhalation RfD (mg/kg-day)	RfDc (mg/kg)	RfDc (mg/kg)
Aroclor-1232	1	-	7.70E+00	-	-	-	-	0.00424412	NA
Aroclor-1242	1	-	7.70E+00	-	-	-	-	0.00424412	NA
Aroclor-1248	1	-	7.70E+00	-	-	-	-	0.00424412	NA
Aroclor-1254	1	-	7.70E+00	-	-	-	-	0.00424412	NA
Aroclor-1260	1	-	7.70E+00	-	-	-	-	0.00424412	NA
Formamide	1	-	-	-	-	4.00E-03	1.14E-03	NA	NA
Propylene dichloride	1	-	-	-	-	-	-	1.39470014	NA
Pyridine	1	-	-	-	-	-	-	NA	NA
Sulfone	1	-	-	-	-	-	-	51.7063082	NA
Selenium	1	-	-	-	-	-	-	10.5999576	NA
Silver	1	-	-	-	-	-	-	4.18410042	NA
1,2,4,5-Tetrachlorobenzene	1	-	-	-	-	3.00E-04	-	1.25691302	418.410042
1,1,2-Tetrachloroethane	1	7.40E-07	2.60E-02	7.40E-06	2.59E-02	3.00E-02	-	0.16339869	NA
1,1,2,2-Tetrachloroethane	1	5.80E-06	2.00E-01	5.80E-05	2.01E-01	-	-	NA	139.470014
Tetrachloroethene	1	-	-	-	-	1.00E-02	-	NA	418.410042
2,3,4,6-Tetrachlorophenol	1	-	-	-	-	3.00E-04	-	NA	6.97335007
Tetrachloropyrophosphate	1	-	-	-	-	-	-	NA	NA
Tetrachlorophosphate	1	-	-	-	-	-	-	NA	NA
Thallium oxide	1	-	-	-	-	-	-	NA	1.18890357
Thallium acetate	1	-	-	-	-	9.00E-05	-	NA	1.05680317
Thallium carbonate	1	-	-	-	-	8.00E-05	-	NA	1.05680317
Thallium chloride	1	-	-	-	-	8.00E-05	-	NA	1.05680317
Thallium nitrate	1	-	-	-	-	9.00E-05	-	NA	1.18890357
Thallium sulfide	1	-	-	-	-	-	-	NA	NA
Thallium sulfate	1	-	-	-	-	8.00E-05	-	NA	1.05680317
Thallium (II) sulfate	1	-	-	-	-	2.00E-01	4.00E-01	1.14E-01	2789.40028
Toluene	1	-	-	-	-	-	-	NA	NA
p-Toluidine	2	5.40E-06	1.90E-01	-	-	-	-	0.17199862	NA
Trasaphene	1	3.20E-05	1.10E+00	3.20E-04	1.12E+00	-	-	0.02970885	NA
1,2,4-Trichlorobenzene	1,2	-	-	-	-	1.00E-02	9.0E-03	2.6E-03	139.470014
1,1,2-Trichloroethane	1	1.60E-06	5.70E-01	1.60E-05	5.59E-02	4.00E-03	-	0.057333287	55.7880056
Trichloroethene	1	-	-	-	-	3.00E-01	-	NA	418.410042
Trichlorophenol	1	-	-	-	-	1.00E-01	-	NA	139.470014

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TABLE 6-2 (continued)

Chemical Name	Reference	Oral Unit Risk 1/(mg/d)	Oral Slope Factor 1/(mg/kg-day)	Inhalation Unit Risk 1/(mg/m <sup>3</sup> )	Inhalation Slope Factor 1/(mg/kg-day)	Oral RfD (mg/kg-day)	Inhalation RfC (mg/m <sup>3</sup> )	Inhalation RfD (mg/kg-day)	RfC <sub>so</sub> (mg/kg)	RfC <sub>ne</sub> (mg/kg)
2,1,6-Trichlorophenol	1	3.10E-07	1.10E-01	3.10E-06	1.08E-01	6.0E-03	-	-	0.29708853	NA
1,2,3-Trichloropropane	1	-	-	-	-	-	-	-	NA	83.6820084
0,0,0-Trichlorophosphorothioate	-	-	-	-	-	-	-	-	NA	NA
2,1,5-Trichlorophenoxyacetic acid	1	-	-	-	-	8.00E-03	-	-	NA	111.576011
2,1,5-Trichlorophenoxypropionic acid	1	-	-	-	-	5.00E-05	-	-	NA	0.69735007
1,3,5-Trinitrobenzene	2	-	-	-	-	2.00E+00	-	-	NA	27894.0028
m-Xylene	2	-	-	-	-	2.00E+00	-	-	NA	27894.0028
p-Xylene	-	-	-	-	-	-	-	-	NA	NA
o-Xylene	-	-	-	-	-	-	-	-	NA	27894.0028
Total Xylene (mixed isomers)	1	-	-	-	-	2.00E+00	-	-	0.01719986	NA
Vinyl chloride	2	5.40E-05	1.90E+00	8.40E-05	3.00E-01	-	-	-	-	-

1. IRIS, April 7, 1994

2. HEAST, FY 1993 Annual and Supplement 1.

3. EPA 1993



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TABLE 6-3

## IDM CONSTITUENTS OF CONCERN

## CARCINOGENS AND NONCARCINOGENS RISK-BASED CONCENTRATIONS FOR SOIL

[illegible]

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[illegible]

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TABLE 6-3 (continued)

Chemical Name	CAS No.	Reference	Oral Unit Risk 1/(mg/L)	Oral Slope Factor 1/(mg/kg-day)	Inhalation Unit Risk 1/(µg/m <sup>3</sup> )	Inhalation Slope Factor 1/(mg/kg-day)	Oral RfD (mg/kg-day)	Inhalation RfC (µg/m <sup>3</sup> )	Inhalation RfD (mg/kg-day)	RfC <sub>ce</sub> (mg/kg)	RfD <sub>ce</sub> (mg/kg)
Vanadium	7440-62-2		-	-	-	-	-	-	-	NA	NA
Vinyl acetate	108-05-4		-	-	-	-	-	-	-	NA	NA
Zinc	7440-66-6	1	-	-	-	-	1.00E-01	-	-	NA	190.87612

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**FORM FO.29E, COMPUTER-GENERATED CLASSIFICATION OF IDM**

FORM FO.29E

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U.S. DEPARTMENT OF ENERGY ROCKY FLATS PLANT

**COMPUTER-GENERATED CLASSIFICATION OF IDM**

Drilling location number or OU                     

Rocky Flats Project:                       
Date Determination Performed:                     

Drum No.                       
Associated                       
Sample                       
Numbers:                     

(1) Analyte Name	(2) Average Concentration (mg/Kg) Avg	(3) Analyte above Mean + 2SD? (Yes/No)	(4) Constituent Concentration > AF X TC (Yes/No)	(5) IDM RCRA Constituent of Concern? (Yes/No)	(6) RCRA Risk Analysis Carcinogenic Ratio (Avg X IF X SL)	(7) RCRA Risk Analysis Noncarcino- genic Ratio (Avg X IF/RFD)	(8) Inclusive Risk Analysis Noncarcinogenic Ratio	(9) Inclusive Risk Analysis Noncarcinogenic Ratio

**SAMPLE**

Drum Deposition:                     

Comments:                     

ERM Risk Analyst:                      Signature                     

Date                     

Signature                     

ERM PM:                     

Date                     

The analytical information described on this form is based on information from potentially unvalidated data from RFEDS. This form has been completed in accordance with 4-H46-ENV-OPS-FO.29. A subcontractor was used in support of completing this form and the work has not been independently verified by the PM. Based on the above, this form is accurate to the best of the PM's knowledge and belief.

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**RISK-ANALYSIS METHOD**

The risk-analysis method used in this procedure will be applied for IDM RCRA Constituents of Concern (RCRA risk analysis) and for all other IDM Constituents of Concern (inclusive risk analysis). In the risk analyses, constituent concentrations in the IDM are compared to chemical-specific Risk-Based Concentrations (RBCs) for soil. The calculation of RBCs is based on multiple exposure pathways (direct ingestion of soil, dermal absorption, inhalation of suspended soil, and ingestion of food grown in contaminated soil), EPA chemical toxicity data, and conservative target risk levels (excess cancer risk of  $10^{-6}$  and HQ of 1 for noncarcinogenic effects).

The RCRA risk analysis will be performed as follows for all IDM RCRA Constituents of Concern:

**Carcinogens:** Ratios of constituent concentrations to RBCs will be calculated and then summed. If the sum is greater than 1 (representing a cumulative cancer risk of  $10^{-6}$ ), the IDM will be managed as a RCRA waste.

**Noncarcinogens:** Ratios of constituent concentrations to RBCs will be calculated and then summed. If the sum exceeds 1 [cumulative Hazard Index (HI) of 1], the IDM will be managed as a RCRA waste.

The inclusive risk analysis will be performed as follows for all IDM Constituents of Concern:

**Carcinogens:** Ratios of constituent concentrations to RBCs will be calculated and then summed. If the sum is greater than 1 (representing a cumulative cancer risk of  $10^{-6}$ ), the IDM will be held in non-RCRA interim storage. If the sum of ratios is 1 or below, the IDM may be removed from storage.

**Noncarcinogens:** Ratios of constituent concentrations to RBCs will be calculated and then summed. If the sum exceeds 1 (cumulative HI of 1), then the IDM will be held in non-RCRA interim storage. If the sum is 1 or below, the IDM may be removed from storage.

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The equations, default exposure parameters, and other factors used in deriving the RBCs are described below.

**Basic Equations for Calculating RBCs for Soil:**

The generic equations used to calculate multiple-pathway RBCs for soil are shown below. The equations are derived using the Environmental Protection Agency (EPA) guidance for risk assessment in accordance with EPA, Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, 1989 and the Colorado Department of Health (CDH) Interim Final Policy and Guidance on Risk Assessments for Corrective Action at RCRA Facilities, November 1993. The CDH guidance was specifically used to obtain the intake parameters in the following equations. RBCs are chemical specific, and are in Appendix 6, Tables 6-2 and 6-3.

Chemical-specific toxicity factors, namely reference doses (RfDs) for noncarcinogenic effects and slope factors (SFs) for carcinogenic effects, are used in calculating the RBCs. These toxicity factors are developed by EPA, and undergo periodic review and revision. In addition, new toxicity factors may become available as additional chemicals are evaluated. The primary source of EPA toxicity factors is the IRIS, an on-line database of EPA-verified toxicity values. The second source for toxicity factors is HEAST for the current year. Additional toxicity information for some chemicals may be available from the EPA Environmental Criteria and Assessment Office (ECAO). The tables containing the toxicity factors will be updated on a periodic basis by the Environmental Restoration Risk Management Group.

Intake factors (IFs) used in the RBC equations shown below are described in detail in this appendix. IFs for noncarcinogenic effects and carcinogenic effects are calculated using slightly different equations. All IFs used in the calculation of RBCs have units of kg soil/kg body-weight per day (kg/kg-day). RfDs have units of mg chemical/kg body weight per day (mg/kg-day). SFs have units of risk per mg/kg-day.

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## Noncarcinogenic Effects:

$$RBC_{nc} = \frac{HQ}{\frac{IF_o + IF_d + IF_f}{RfDo} + \frac{IF_i}{RfDi}}$$

- where  $RBC_{nc}$  = Risk-based concentration for noncarcinogenic effects of chemicals in soil (chemical specific) (mg chemical/kg soil)
- $HQ$  =  $HQ$  for noncarcinogenic effects = 1
- $IF_o$  = Oral intake factor for soil ingestion (kg/kg-day)
- $IF_d$  = Dermal intake factor for dermal absorption from soil (kg/kg-day)
- $IF_f$  = Oral intake factor for ingestion of homegrown produce (kg/kg-day)
- $IF_i$  = Inhalation intake factor for inhalation of suspended soil (kg/kg-day)
- $RfDo$  = Oral reference dose (chemical specific) (mg/kg-day)
- $RfDi$  = Inhalation reference dose (chemical specific) (mg/kg-day)

## Carcinogenic Effects:

$$RBC_c = \frac{10^{-6}}{(IF_o + IF_d + IF_f) \times SF_o + IF_i \times SF_i}$$

- where  $RBC_c$  = Risk-based concentration for carcinogenic effects of chemicals in soil (chemical specific) (mg/kg)
- $10^{-6}$  = Target cancer risk level (1 in 1,000,000)
- $IF_{o,d,f,i}$  = Same as previous equation.
- $SF_o$  = Oral cancer slope factor (chemical specific) (1/[mg/kg-day])
- $SF_i$  = Inhalation cancer slope factor (chemical specific) (1/[mg/kg-day])

The equations are generic since all pathways do not apply to all chemicals, and toxicity factors are not available for all chemicals. Specific pathways that are not addressed for some chemicals include inhalation of volatile organics as particulate matter, uptake of non-metals by food grown in soil, and dermal absorption of polycyclic aromatic hydrocarbons. Volatile organics evaporate from airborne soil particles, and therefore, will not be inhaled as particulate matter. In addition, only metals are primarily taken up by food plants. In cases where toxicity factors do not exist for a given pathway, that pathway will not be included in the RBC calculation.

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**Intake Factors and Exposure Parameters:**

The calculation of IFs for soil ingestion, dermal absorption, inhalation of particulates, and ingestion of food grown in soil are shown below. The exposure assumptions are based on CDH default values (CDH 1993).

**Ingestion of Soil (Time-weighted average):**

$$IF = \left[ \frac{(IR_{child})(ED_{child})}{(BW_{child})} + \frac{(IR_{adult})(ED_{adult})}{(BW_{adult})} \right] \frac{(CF)(EF)}{(AT)}$$

where IF	=	Intake factor	=	1.6E-06 kg/kg-day (carcinogens)
			=	3.7E-06 kg/kg-day (noncarcinogens)
IR <sub>child</sub>	=	Ingestion rate for child ages 1-6	=	200 mg/day
IR <sub>adult</sub>	=	Ingestion rate for ages 7 and up	=	100 mg/day
ED <sub>child</sub>	=	Exposure duration for child 1-6	=	6 yr
ED <sub>adult</sub>	=	Exposure duration for adult	=	24 yr
BW <sub>child</sub>	=	Body weight for child 1-6	=	15 kg
BW <sub>adult</sub>	=	Body weight for adult	=	70 kg
CF	=	Conversion factor	=	1E-06 kg/mg
EF	=	Exposure frequency	=	350 days/yr
AT	=	Averaging time	=	25,550 days (70 yr) (carcinogens)
			=	10,950 days (30 yr) (noncarcinogens)



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Dermal Absorption from Soil (Time-Weighted Average)

$$IF = \left[ \frac{(SA_{child}) (ED_{child})}{(BW_{child})} + \frac{(SA_{adult}) (ED_{adult})}{(BW_{adult})} \right] \frac{(AB) (AF) (EF) (CF)}{(AT)}$$

where IF	=	Intake Factor	= 2.9E-05 kg/kg-day (carcinogens) = 6.8E-05 kg/kg-day (noncarcinogens)
SA <sub>child</sub>	=	Exposed skin surface area for child ages 1-6	= 4,600 cm <sup>2</sup>
SA <sub>adult</sub>	=	Exposed skin surface area for ages 7 and up	= 7,100 cm <sup>2</sup>
ED <sub>child</sub>	=	Exposure duration for child ages 1-6	= 6 years
ED <sub>adult</sub>	=	Exposure duration for ages 7 and up	= 24 years
BW <sub>child</sub>	=	Body weight for child ages 1-6	= 15 kg
BW <sub>adult</sub>	=	Body weight for adult	= 70 kg
AB	=	Absorption factor	= 0.5 (unitless)
AF	=	Adherence factor	= 1.0 mg/cm <sup>2</sup> /event
EF	=	Exposure frequency	= 350 events/year
CF	=	Conversion factor	= 1E-06 kg/mg
AT	=	Averaging time	= 25,550 days (70 years) (carcinogens) = 10,950 days (30 years) (noncarcinogens)

EPA (EPA 1989) guidance states that it is inappropriate to use oral slope factors as a measure of dermal absorption for carcinogenic polycyclic aromatic hydrocarbons (PAHs). Therefore, dermal absorption of PAHs is not included in calculating RBCs for PAHs.

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Inhalation of Soil Particulates (Time-weighted Average):

$$IF = \left[ \frac{(IR_{child}) (ED_{child})}{(BW_{child})} + \frac{(IR_{adult}) (ED_{adult})}{(BW_{adult})} \right] \frac{(CF) (ET) (EF)}{(PEF) (AT)}$$

where IF = Intake factor = 4.1E-11 kg/kg-day (carcinogens)  
= 9.6E-11 kg/kg-day (noncarcinogens)

IR<sub>child</sub> = Inhalation rate for child ages 1-6 = 0.73 m<sup>3</sup>/hour

IR<sub>adult</sub> = Inhalation rate for ages 7 and up = 0.83 m<sup>3</sup>/hour

ED<sub>child</sub> = Exposure duration for child ages 1-6 = 6 years

ED<sub>adult</sub> = Exposure duration for ages 7 and up = 24 years

BW<sub>child</sub> = Body weight for child ages 1-6 = 15 kg

BW<sub>adult</sub> = Body weight for adult = 70 kg

CF = Conversion factor = 1E-06 kg/mg

ET = Exposure time = 24 hours/day

EF = Exposure frequency = 350 days/year

PEF = Particulate emission factor = 4630 m<sup>3</sup>/mg

AT = Averaging time = 25,550 days (70 years) (carcinogens)

= 10,950 days (30 years) (noncarcinogens)

Ingestion of Homegrown Fruits and Vegetables (Time-Weighted Average)

$$IF = \left[ \frac{(ED_{child})}{(BW_{child})} + \frac{(ED_{adult})}{(BW_{adult})} \right] \frac{(IR) (FI) (EF) (CF) (TC)}{(AT)}$$

where IF = Intake factor = (TC)(4.5E-04) kg/kg-day (carcinogens)  
= (TC)(1.0E-03) kg/kg-day (noncarcinogens)

ED<sub>child</sub> = Exposure duration for child ages 1-6 = 6 years

ED<sub>adult</sub> = Exposure duration for ages 7 and up = 24 years

BW<sub>child</sub> = Body weight for child ages 1-6 = 15 kg

BW<sub>adult</sub> = Body weight for adult = 70 kg

IR = Ingestion rate = 122,000 mg/day

FI = Fraction ingestion from a contaminated source = 0.36

EF = Exposure frequency = 350 days/year

CF = Conversion factor = 1E-06 kg/mg

TC = Chemical-specific soil to plant transfer coefficient

AT = Averaging time = 25,550 days (70 years) (carcinogens)